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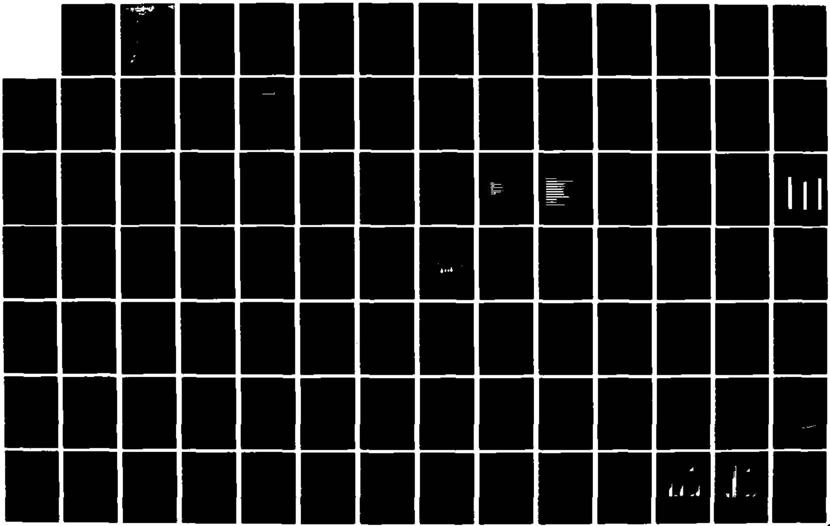

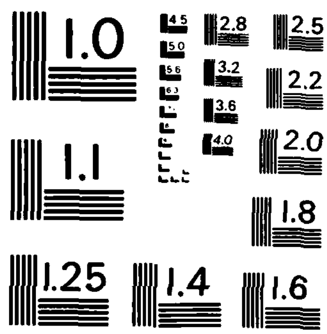

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Chesapeake Bay Study - Summary

PPLEMENT A - PROBLEM IDENTIFICATION
PPLEMENT B - PUBLIC INVOLVEMENT
PPLEMENT C - THE CHESAPEAKE BAY HYDRAULIC MODEL

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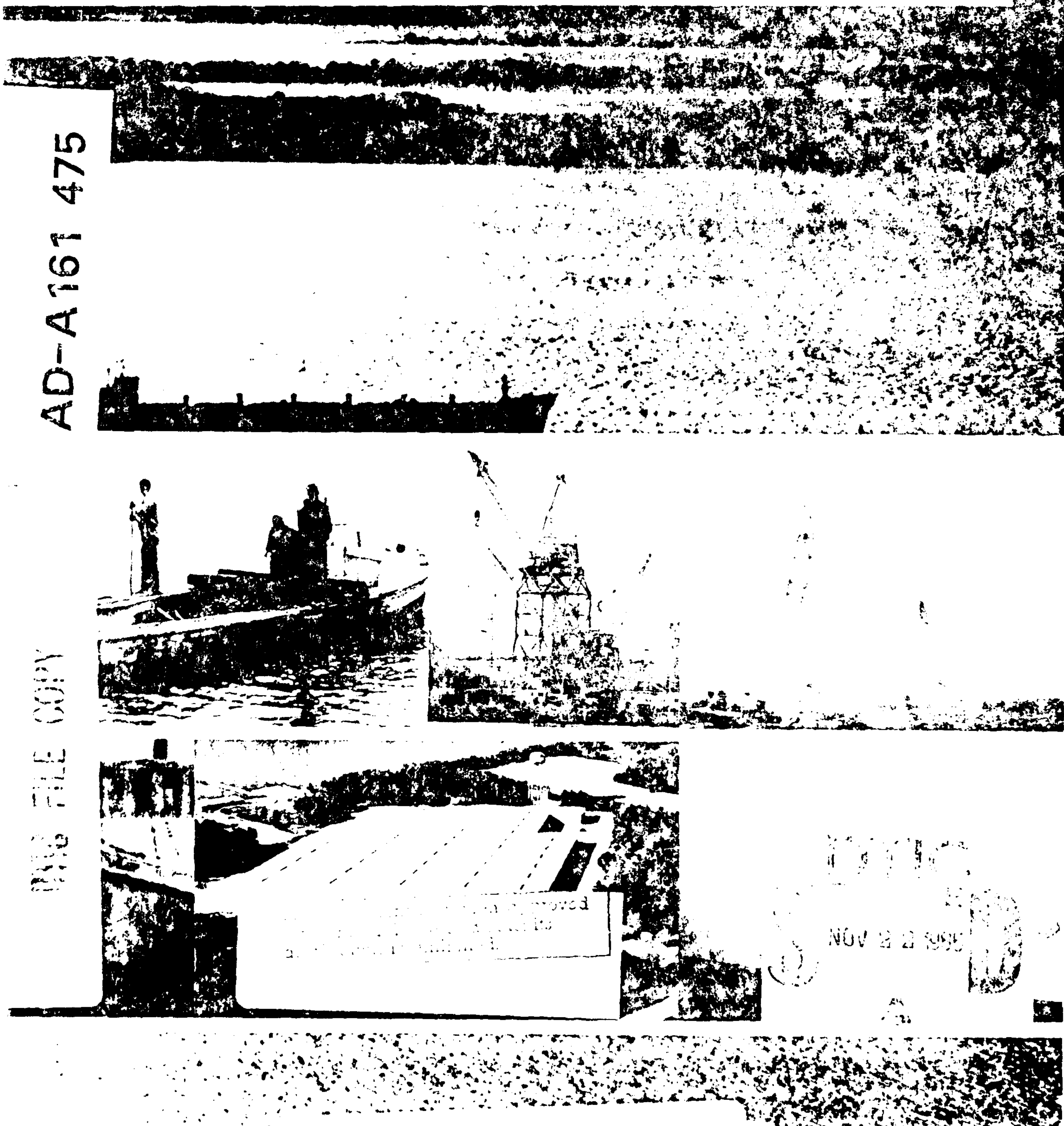

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

In response to Section 312 of the River and Harbor Act of 1965, the Baltimore District of the U.S. Army Corps of Engineers, conducted a comprehensive study of the Chesapeake Bay Basin. Initiated in 1967, the study was performed in 3 phases over a 17 year period. The first phase was to assess the existing conditions of Chesapeake Bay, the second phase, to project the future water resource needs to the year 2020, and the last phase, to formulate and recommend solutions to the Low Freshwater Inflow and Tidal Flooding problems. In conjunction with the study, a hydraulic model of Chesapeake Bay was constructed.

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20. ABSTRACT

Tests were performed on the model not only for the study but also for other Corps' programs, Federal and state agencies and educational institutions.

The report contains summaries of the Existing Conditions and Future Conditions Reports, the Impact of Tropical Storm Agnes on Chesapeake Bay which was performed as part of this study program, the Low Freshwater Inflow Study and the Tidal Flooding Study.

In addition to those for the Low Freshwater Inflow and Tidal Flooding Studies, recommendations in the final report include: (1) conduct a comprehensive Bay-wide study to develop plans for dredged material disposal; (2) conduct further studies to determine the effects of the C&D Canal on Bay salinities; and (3) conduct a periodic update of the information in the Future Conditions Report.

Chesapeake Bay Study - Summary

SUPPLEMENT A - PROBLEM IDENTIFICATION
SUPPLEMENT B - PUBLIC INVOLVEMENT
SUPPLEMENT C - THE CHESAPEAKE BAY HYDRAULIC MODEL

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**US Army Corps
of Engineers**
Baltimore District

September 1984

CHESAPEAKE BAY STUDY

SUMMARY REPORT

SUPPLEMENT A

PROBLEM IDENTIFICATION

Department of the Army
Baltimore District Corps of Engineers
Baltimore, Maryland
September 1984

FOREWORD

This is one of the volumes comprising the final report on the Corps of Engineers' Chesapeake Bay Study. The report represents the culmination of many years of study of the Bay and its associated social, economic, and environmental processes and resources. The overall study was done in three distinct developmental phases. A description is provided below of each study phase, followed by a description of the organization of the report.

The initial phase of the overall program involved the inventory and assessment of the existing physical, economic, social, biological, and environmental conditions of the Bay. The results of this effort were published in a seven volume document titled Chesapeake Bay Existing Conditions Report, released in 1973. This was the first publication to present a comprehensive survey of the tidal Chesapeake and its resources as a single entity.

The second phase of the program focused on projection of water resource requirements in the Bay Region for the year 2020. Completed in 1977, the Chesapeake Bay Future Conditions Report documents the results of that work. The 12-volume report contains projections for resource categories such as navigation, recreation, water supply, water quality, and land use. Also presented are assessments of the capacities of the Bay system to meet the identified future requirements, and an identification of problems and conflicts that may occur with unrestrained growth in the future.

In the third and final study phase, two resource problems of particular concern in Chesapeake Bay were addressed in detail: low freshwater inflow and tidal flooding. In the Low Freshwater Inflow Study, results of testing on the Chesapeake Bay Hydraulic Model were used to assess the effects on the Bay of projected future depressed freshwater inflows. Physical and biological changes were quantified and used in assessments of potential social, economic, and environmental impacts. The Tidal Flooding Study included development of preliminary stage-damage relationships and identification of Bay communities in which structural and nonstructural measures could be beneficial.

The final report of the Chesapeake Bay Study is composed of three major elements: (1) Summary, (2) Low Freshwater Inflow Study, and (3) Tidal Flooding Study. The Chesapeake Bay Study Summary Report includes a description of the results, findings, and recommendations of all the above described phases of the Chesapeake Bay Study. It is incorporated in four parts:

Summary Report
Supplement A — Problem Identification
Supplement B — Public Involvement
Supplement C — Hydraulic Model

The Low Freshwater Inflow Study consists of a Main Report and six supporting appendices. The report includes:

Main Report
Appendix A — Problem Identification
Appendix B — Plan Formulation
Appendix C — Hydrology
Appendix D — Hydraulic Model Test

Appendix E — Biota
Appendix F — Map Folio

The Tidal Flooding Study consists similarly of a Main Report and six appendices. The report includes:

Main Report
Appendix A — Problem Identification
Appendix B — Plan Formulation, Assessment, and Evaluation
Appendix C — Recreation and Natural Resources
Appendix D — Social and Cultural Resources
Appendix E — Engineering, Design, and Cost Estimates
Appendix F — Economics

CHESAPEAKE BAY STUDY
SUMMARY REPORT
SUPPLEMENT A - PROBLEM IDENTIFICATION

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SUPPLEMENT A

PROBLEM IDENTIFICATION

INTRODUCTION

Chesapeake Bay is a vast natural, economic, and social resource. Along with its tributaries, the Bay provides a transportation network on which much of the economic development of the Region has been based, a wide variety of water-oriented recreational opportunities, a home for numerous fish and wildlife, a source of water supply for both municipalities and industries, and the site for the disposal of many of our waste products. The natural resources and processes of the Bay and man's activities interact to form a complex and interrelated system. Unfortunately, problems often arise when man's intended use of one resource conflicts with either the natural environment or man's use of another resource. It was the need for a plan to provide for the most efficient use of the Bay's resources that provided the impetus for the initiation of the Chesapeake Bay Study.

STUDY AUTHORITY

The authority for the Chesapeake Bay Study and the construction of the hydraulic model is contained in Section 312 of the River and Harbor Act of 1965, adopted 27 October 1965, which reads as follows:

(a) The Secretary of the Army, acting through the Chief of Engineers, is authorized and directed to make a complete investigation and study of water utilization and control of the Chesapeake Bay Basin, including the waters of the Baltimore Harbor and including, but not limited to, the following: navigation, fisheries, flood control, control of noxious weeds, water pollution, water quality control, beach erosion, and recreation. In order to carry out the purposes of this section, the Secretary, acting through the Chief of Engineers, shall construct, operate, and maintain in the State of Maryland a hydraulic model of the Chesapeake Bay Basin and associated technical center. Such model and center may be utilized, subject to such terms and conditions as the Secretary deems necessary, by any department, agency, or instrumentality of the Federal Government or of the States of Maryland, Virginia, and Pennsylvania, in connection with any research, investigation, or study being carried on by them of any aspect of the Chesapeake Bay Basin. The study authorized by this section shall be given priority.

(b) There is authorized to be appropriated not to exceed $6,000,000 to carry out this section.

An additional appropriation for the Study was provided in Section 3 of the River Basin Monetary Authorization Act of 1970, adopted 19 June 1970, which reads as follows:

In addition to the previous authorization, the completion of the Chesapeake Bay Basin Comprehensive Study, Maryland, Virginia, and Pennsylvania, authorized by the River and Harbor Act of 1965 is hereby authorized at an estimated cost of $9,000,000.

As a result of Tropical Storm Agnes, which caused extensive damage in Chesapeake Bay, Public Law 92-607, the Supplemental Appropriation Act of 1973, signed by the President on 31 October 1972, included $275,000 for additional studies of the impact of the storm on Chesapeake Bay.

STUDY PURPOSE AND SCOPE

Historically, measures taken to utilize and control the water and land resources of the Chesapeake Bay Basin were generally oriented toward solving individual problems. The Chesapeake Bay Study was initiated in 1967 to provide a comprehensive study of the entire Bay area in order that the most beneficial use be made of the water-related resources. The major objectives of the study were to:

a. Assess the existing physical, chemical, biological, economic, and environmental conditions of Chesapeake Bay and its water resources.

b. Project the future water resources needs of Chesapeake Bay to the year 2020.

c. Formulate and recommend solutions to priority problems using the Chesapeake Bay Hydraulic Model.

In response to the first objective of the study, the initial or inventory phase of the program was completed in 1973 and the findings were published in a document titled Chesapeake Bay Existing Conditions Report.

Included in this seven-volume report is a description of the existing physical, economic, social, biological and environmental conditions of Chesapeake Bay. This was the first published report that presented a comprehensive survey of the entire Bay Region and treated Chesapeake Bay as a single entity. Most importantly, the report contains much of the basic data required to project the future demands on the Bay and to assess the ability of the resource to meet those demands.

In response to the second objective of the study, the findings of the second or future projections phase of the program were provided in the Chesapeake Bay Future Conditions Report published in 1978. The primary focus of that report was the projection of water resources needs to the year 2020 and the identification of the problems and conflicts which would result from the unrestrained growth and use of the Bay's resources. That report provided the basic information necessary to proceed into the detailed study phase of the program.

Given the problems and needs identified in the Chesapeake Bay Future Conditions Report, the priority problems to be examined in detail were selected and the hydraulic model testing in support of those studies was conducted. This the final report of the Chesapeake Bay Study provides both an overview of the findings incorporated in the earlier Existing and Future Conditions reports and the results of the detailed studies conducted in final phase of the study.

The expertise required for the conduct of the Chesapeake Bay Study included the fields of engineering and the social, physical and biological sciences. The study was coordinated with Federal, state, and local agencies having an interest in Chesapeake Bay. Each

resource category or problem area was treated on an individual basis with demands and potential problem areas projected to the year 2020. All conclusions are based on historical information supplied by the preparing agencies having expertise in that field.

As directed in the authorization, the study also included the construction, operation and maintenance of a hydraulic model of Chesapeake Bay. Actual construction of the 14-acre model and shelter was begun in June 1973 and completed in April 1976. Adjustment and verification of the model was completed in 1978. Testing was conducted on the model through January 1982.

The hydraulic model provides a means of reproducing to a manageable scale many natural events and man-made changes thereby allowing the collection of the data necessary to assess the consequences of these happenings. As an instrument and physical display, the hydraulic model served to educate the public relative to the complexity of the Bay's problems and conflicts. As an operational focal point, the model promoted more effective liaison among the agencies working on the Bay waters, helping to reduce duplication of effort and aiding in the dispersion of knowledge among the interested parties.

STUDY AREA

As shown on Figure A-1, the study area encompasses the counties or Standard Metropolitan Statistical Areas (SMSA) which adjoin or have a major influence on the estuary. The area delineated in Figure A-1 is referred to as the "Study Area" or "Bay Region" throughout this report unless otherwise noted. As it relates to the Low Freshwater-Inflow Study, consideration was given to the entire Chesapeake Bay Drainage Basin. A more detailed description of the drainage basin is provided in that report.

STUDY ORGANIZATION AND MANAGEMENT

The magnitude of the Chesapeake Bay Study, the large number of participants, and the complex spectrum of problems to be analyzed required intensive coordination of activities. The initial planning of this study was coordinated with the then National Council of Marine Resources and Engineering Development through its Committee on Multiple Use of the Coastal Zone. This study was conceived as a coordinated partnership among Federal, state, and local agencies and interested scientific institutions. Each involved agency was charged with exercising leadership in those disciplines in which it had special competence and was expected to review and comment on work performed by others. To realize these ends, an Advisory Group, a Steering Committee, and 5 Task Groups, as shown in Figure A-2, were established.

The overall management of the Chesapeake Bay Study was the responsibility of the District Engineer of the Baltimore District, Corps of Engineers. Supplement B, Public Involvement, of this report provides a more detailed discussion of the scope and nature of the study organization and coordination.

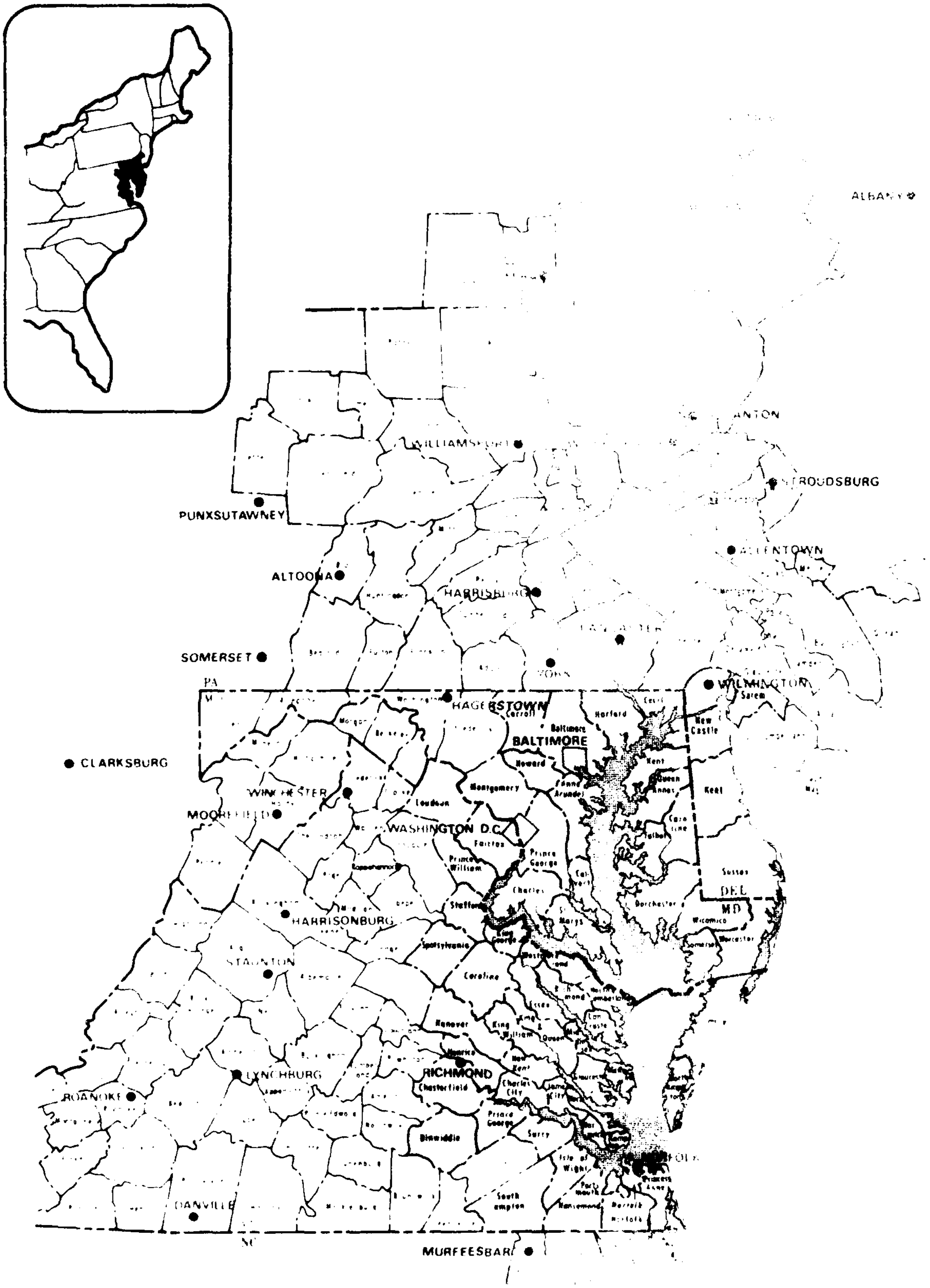


FIGURE A-1 CHESAPEAKE BAY STUDY AREA

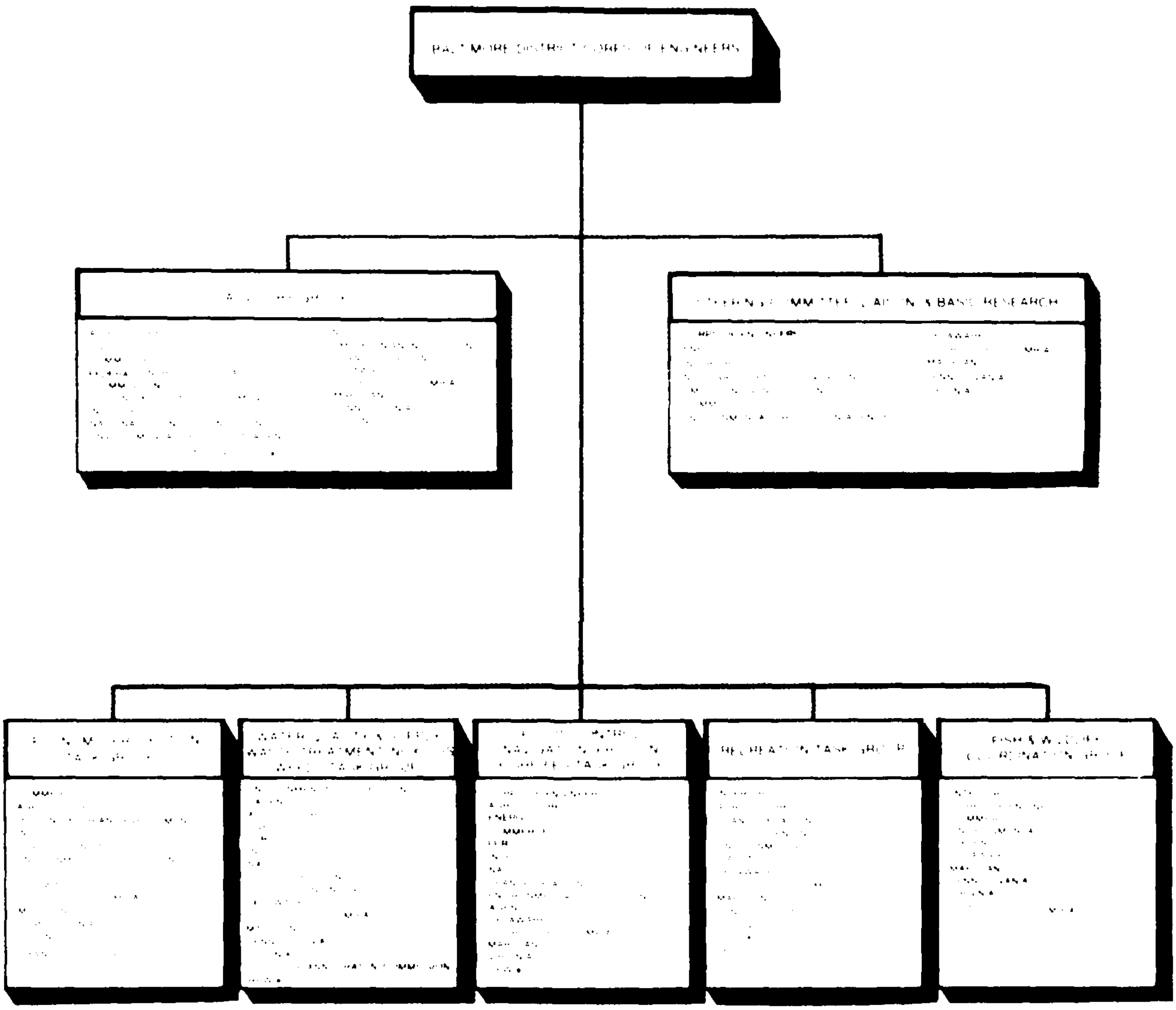


FIGURE A-2 CHESAPEAKE BAY STUDY ORGANIZATION

PURPOSE OF SUPPLEMENT

The purpose of this supplement is to provide a brief description of the various activities and characteristics of the Bay Region that were relevant considerations in the study effort. Recent water resources planning activities and natural, socio-economic and institutional characteristics of the study area are discussed. Those factors relating to the existing conditions in the Bay Region are used as a basis for projecting the future conditions which in turn serve to aid in the presentation and development of the problems and needs. Lastly, this supplement presents the rationale for the selection of those priority problems that were selected for detailed study in the final phase of the study.

PLANNING BACKGROUND - NEED FOR A STUDY

The need for a complete and comprehensive investigation of the Chesapeake Bay area had long been recognized. The concept of developing the Nation's water resources through single-purposed programs and projects was on the wane by the conclusion of the Korean conflict. At that time, funds were made available for the conduct of a large backlog of investigations. These studies were authorized, but had not been started because of curtailment of the civil works program by Executive Order. Some of the requests for improvements appeared to be duplications and, in some cases, in direct conflict with one another. The evolution of regional concepts for the development of water resources was a logical result. In terms of Chesapeake Bay, a first step toward what might be considered a comprehensive study was the Chesapeake Bay Fishing Harbor Economics Study, Maryland and Virginia. This study provided, for the first time, a broad overview of the commercial fishing industry and a firm and consistent basis for the comparison of primary fishing benefits among harbors throughout the Bay Area.

In 1961, in response to the recommendation of the Senate Select Committee on National Water Resources (as contained in Senate Report No. 29, Eighty-Seventh Congress, First Session, made pursuant to Senate Resolution 48, 86th Congress) that a program be formulated to meet the Nation's water resources needs, the District Engineer, Baltimore District, prepared a pamphlet concerning the Chesapeake Bay Area entitled An Appraisal of Water Resource Needs Projected to the Year 2060. In the spirit of the Senate Committee's recommendation, this pamphlet recommended that a cooperative study of Chesapeake Bay be made by the Federal and state agencies concerned with the Bay's resources.

In the same year, a basin plan for Chesapeake Bay (Basin Plan, Chesapeake Bay) was prepared by the Baltimore District in cooperation with the Norfolk District in compliance with instructions from the Office of the Chief of Engineers. The plan was based on readily available information and consisted of a brief description of the current status of water development and planning in the Chesapeake Bay Area. It included comments on the adequacy of the plan and future demands on the region's water resources. In addition, it presented a program for bringing the basin plan up to date. Although it was the first attempt at bringing together comprehensive information on the Bay's resources, it represented only a superficial analysis.

Based on the two Corps reports mentioned above and similar studies and analyses conducted by other agencies it was recognized that with rapidly increasing population and its attendant demands, the resources of the area, including water supply, waterborne commerce, seafood, recreation, and fish and wildlife resources, were receiving pressures which could only be expected to increase in the years ahead. Thus, water resources

managers and scientists in the Bay Region felt that a comprehensive study of the Bay and its resources was required in order to develop a Bay-wide management plan.

During this same period, certain Congressional representatives with districts within the Bay Region were expressing interest in a comprehensive Bay study and the construction of a hydraulic model of the Chesapeake Bay similar to the San Francisco Bay and the Mississippi River basin models. It was envisioned that such a model would be used as part of the study decision-making process.

On 23 February 1965, a bill was introduced by Congressman Hervey G. Machen of Maryland to authorize the Secretary of the Army to conduct a complete investigation and study of water utilization and control of the Chesapeake Bay Basin. To carry out this investigation, a hydraulic model of the Chesapeake Bay Basin and associated technical center were to be constructed. Shortly after introduction of this bill, three other nearly identical bills were introduced by Congressmen Thomas N. Downing of Virginia and Rogers C. B. Morton and George H. Fallon of Maryland.

In July 1965, the Senate version of the River and Harbors Act of 1965 was introduced and it also included a section authorizing a comprehensive Bay study that was very similar to that proposed in the aforementioned House bills. Following some changes, the authority for the study was provided in Section 312 of the River and Harbor Act of 1965 signed by the President on 27 October 1965. The authority was previously quoted in this Supplement.

Prior to passage of the Act and in testimony before the House Committee on Public Works, the sponsors and supporters of the legislation presented certain statements in favor of the study. The statements by these Congressional Representatives expressed their objectives for the Bay study and its associated hydraulic model.

Generally, it was believed that the growing population and development of the Region demonstrated the need for the creation of a fully integrated basin plan for optimum development. Increasing pressures on the Region's water and related land resources also indicated the need to alleviate the major water resource problems of the Bay such as siltation, beach erosion, noxious aquatic growths, flood control, water pollution, disposal of dredged material, and protection of the shellfish industry. It was pointed out that the Bay study and its associated hydraulic model were necessary "to create a tool and facility to assist the existing agencies in carrying out their missions." The model, by providing insight into the hydraulic and hydrographic mechanisms operating in the Bay, was believed necessary to serve and preserve the Bay and would, in addition, benefit "every water resource problem in every state in the Nation."

For a more detailed discussion of the history of the Chesapeake Bay Study the reader is referred to Supplement B, Public Involvement.

NATURAL RESOURCES OF THE STUDY AREA

GEOLOGY

The Chesapeake Bay Region is divided into two geologic provinces - the Coastal Plain and the Piedmont Plateau. These provinces run roughly parallel to the Atlantic Ocean in similar fashion to the Bay itself and join at the Fall Line. This natural line of demarcation generally marks both the limit of tide as well as the head of navigation.

The Coastal Plain Province includes the Eastern Shore of Maryland and Virginia, most of Delaware, and a portion of the Western Shore. On the Eastern Shore and in portions of the Western Shore adjacent to the Bay, the Coastal Plain is largely low, featureless, and frequently marshy, with many islands and shoals sometimes extending far offshore. The Province is a gently rolling upland on the Western Shore and in the northern portions of the Eastern Shore. The Coastal Plain reaches its highest elevation in areas along its western margin.

The composition of the Coastal Plain is primarily unconsolidated, southeasterly-dipping, sedimentary layers such as sand, clay, marl, gravel, and diatomaceous earth resting on a base of hard crystalline rock. These layers, which can be readily seen in areas where wells have been drilled, increase in thickness towards the Continental Shelf. In a few isolated areas and in locations where water has cut a deep channel, the basement rock is exposed in ridges.

The Piedmont Plateau is not, as its name implies, a plateau. It is characterized by low hills and ridges which tend to rise above the general lay of the land reaching a maximum height near the Appalachian Province on the west. Many of the stream valleys are quite narrow and steep-sided, having been cut into the hard crystalline rocks which are characteristic of the Province.

The parent material of the Piedmont Province is both older and more complicated than that of the Coastal Plain. The structurally complex crystalline rocks have been severely folded and subjected to great heat and pressure thereby creating metamorphic rocks.

SOILS

Soils consist of a thin layer of material made from broken and decomposed rock with added products of decaying organic matter called humus. The Study Area contains soils produced from the three major types of rock, namely igneous, metamorphic, and sedimentary. The first two types are found primarily in the Piedmont Province, whereas the Coastal Plain is composed of sediments.

Climate appears to have a definite effect on soil development. Although the Study Area is generally characterized by a humid climate, local variations in temperature and rainfall produce some differences in soil type. Soil characteristics (texture, drainage, structure, particle size, physical composition, and degree of development) have had a strong role in determining soil usefulness. Richer, well-drained soils are more productive in terms of agriculture. Few crops can grow on soils which are poorly drained or which lack plant nutrients. Soils on the Coastal Plain are highly variable with regard to drainage characteristics and most need liming to neutralize their naturally acidic condition. Piedmont soils are medium-grained, easily tilled, and of generally higher fertility than those of the Coastal Plain. A few soils are impermeable when wet, retarding the movement of water and causing waterlogging. As a result, strong surface runoff causes serious erosion of slopes.

CLIMATE

The Chesapeake Bay Study Area is characterized by a generally moderate climate, due in a large part to the area's proximity to the Atlantic Ocean. Variations occur, however, on a local, basis due to the large geographical size of the Study Area.

Precipitation within the Bay Region was studied at selected stations during a 30-year sample record from 1931 to 1960. The average for the Study Area was 44 inches per year, with geographical variations from about 40 to 46 inches per year. Snowfall, included in the precipitation totals, averaged 13 inches per year and occurred generally between November and March.

Three types of storm activity bring precipitation to the Region. The first type consists of extratropical storms or "lows" which originate to the west, either in the Rocky Mountains, Pacific Northwest, or the Gulf of Mexico. The second is tropical storm or hurricane activity which originates in the Middle Atlantic or the Caribbean Sea region. The third is thunderstorm activity which is almost always on a local scale. It is this last activity which brings about the greatest amount of local variation in precipitation in the Bay Region.

Evapotranspiration, which includes water losses due to evaporation from land and water surfaces and transpiration from plants, amounts to approximately 60 percent of the annual precipitation or about 26 inches per year. Authorities estimate an annual evaporation of 36 to 40 inches from the Bay itself.

The average temperature for the Study Area is approximately 57 degrees Fahrenheit (^{o}F). The Bay is oriented in a north-south direction, however, and covers a wide latitudinal area, allowing wide temperature variances. As a result, the temperature at the head of the Bay averages less than 55^{o}F, while at the mouth it averages almost 60^{o}F, with some peripheral effect due to the nearness of the Atlantic Ocean.

SURFACE WATER HYDROLOGY

The source of freshwater for the Bay is runoff from a drainage basin covering about 64,160 square miles. Approximately 88 percent of this basin is drained by five major rivers, including the Susquehanna, Potomac, Rappahannock, York, and James (see Table A-1).

These river basins are subject to periodic large, climatic extremes, resulting in large fluctuations in flow, i.e., droughts and floods. Of these, droughts are the more geographically widespread and long-term in nature. The Susquehanna, Potomac, Rappahannock, York, and James Rivers together provide nearly 90 percent of the Bay's mean annual inflow of approximately 69,800 cubic feet per second.

TABLE A-1
BASIN CHARACTERISTICS OF MAJOR CHESAPEAKE BAY TRIBUTARIES

River Basin	Drainage Area at Mouth (Sq. Mi.)	River Length (Mi.)
Susquehanna	27,510	453
Potomac	14,217	407
Rappahannock	2,885	184
York	2,857	130
James	10,187	434

GROUNDWATER RESOURCES

Large reservoirs of high quality freshwater are located in the groundwater aquifers of the Chesapeake Bay Region. Aquifers are subsurface sand and gravel-type materials with relatively high ability to conduct water. Water levels in the aquifers fluctuate according to the balance between precipitation and aquifer recharge, on the one hand, and evapotranspiration, runoff, and withdrawals on the other hand. Of the average precipitation of 44 inches per year (in the Study Area), an estimated 9 to 11 inches actually contributes to the recharge of the groundwater reservoirs.

Of the more productive aquifers in the Chesapeake Bay area, the water-bearing formations known as the Columbia Group produce very high yields. Extensive areas on the Eastern Shore and portions of Harford and Baltimore Counties, Maryland, are the principal users. The Piney Point Formation is important in Southern Maryland, portions of Maryland's Eastern Shore and in areas near the Fall Line in Virginia. Lastly, the Potomac Group provides water to Anne Arundel, Charles, and Prince Georges Counties, Maryland and is the most important source of groundwater in the Coastal Plain of Virginia.

THE CHESAPEAKE BAY

The Chesapeake Bay is a mere youngster, geologically speaking. It is generally believed that the Bay was formed about 10,000 years ago, at the end of the last Ice Age, when the great glaciers melted and poured uncountable billions of gallons of water back into the world's oceans. As a result of this great influx of water, the ocean level rose several hundred feet and inundated large stretches of the coastal rivers. The ancient Susquehanna, which had drained directly into the Atlantic Ocean near what is now the mouth of the Bay, was one of these "drowned" waterways. Because the area around the old Susquehanna was characterized by relatively low relief, the estuary that was formed by this mixing of salt and freshwater covered a large geographical area but was relatively shallow. This newly formed body of water was later to be named "Chesapeake Bay." Chesapeake Bay varies from 4 to 30 miles in width and is about 200 miles long. Although the Chesapeake is the largest estuary in the United States, with a surface area of approximately 4,400 square miles, the average depth of the Bay proper is only about 28 feet and about two-thirds of the Bay is eighteen feet deep or less. There are, however, deep holes which generally occur as long narrow troughs. These troughs are thought to be the remnants of the ancient Susquehanna River valley. The deepest of these holes is about 174 feet and occurs off Kent Island.

Chesapeake Bay is a complex, dynamic system. Words like "restless," "unstable," and "unpredictable," which generally describe the young of most animal species, can also be used to describe the young estuary. The ebb and flood of the tides and the incessant action of the waves are the most readily perceptible water movements in the Bay. Average maximum tidal currents range from 0.5 knots to over 2 knots (1 knot equals 1 nautical mile (6,076 feet) per hour). The mean tidal fluctuation in Chesapeake Bay is small, generally between one and two feet. Except during periods of unusually high winds, waves in the Bay are relatively small, generally less than 3 feet in height.

Within the Bay proper and its major tributaries, there is superimposed on the tidal currents, a less obvious, non-tidal, two-layered circulation pattern that provides a net seaward flow of lighter, lower salinity water in the upper layer and a flow up the estuary of heavier, higher salinity waters in the deeper layer. This phenomenon is illustrated in Figure A-3. The tidal currents provide some of the energy necessary for the mixing of the two layers.

Tides and wave action (as well as other types of currents) are biologically significant in several ways. They provide mixing, transportation, and distribution of inorganic and organic nutrients. These water movements also affect the dispersion of eggs, larva, spores, gametes, and smaller advanced stages of resident plants and animals; remove waste products and bring food and oxygen to fixed bottom-dwelling organisms; and circulate chemical "clues" which aid predators in locating their prey. Tides and waves are also especially important ecologically to the intertidal zone (the shoreline area between high and low tides) of an estuary because of their wetting action which is beneficial to many plant and animal species. In sheltered waters, the mixing of water by tidal and wave action is important for the prevention of excessively high temperatures and salinity stratification which could be harmful to some biota. The turbulence caused by wave action also plays a role in aeration of the waters to provide sufficient oxygen for biotic respiration.

The mixing in the estuary of sea water and freshwater creates salinity variations within the system. In Chesapeake Bay, salinities range from 33 parts per thousand at the mouth of the Bay to near zero at the north end of the Bay and at the heads of the embayments tributary to the Bay. Higher salinities are generally found on the Eastern Shore than on a comparable area of the Western Shore due to the greater river inflow on the Western Shore and to the earth's rotation. Salinity patterns also vary seasonally according to the amount of freshwater inflow into the Bay system. Figure A-4 illustrates these phenomena.

Due to this seasonal variation in salinity and the natural density differences between fresh and saline waters, significant non-tidal circulation often occurs within the Bay's small tributary embayments. In the spring, during the period of high freshwater inflow to the Bay, salinity in the embayments may be greater than in the Bay. Because of this salinity difference, surface water from the Bay flows into the tributaries on the surface, while the heavier, more saline bottom water from the tributaries flows into the Bay along the bottom. As Bay salinity becomes greater through summer and early fall, Bay waters flow into the bottom of the tributaries, while tributary surface waters flow into the Bay.

The natural variations in salinity that occur in the Bay are part of the dynamic nature of the estuary, and the resident species of plants and animals are ordinarily able to adjust to the changes. Sudden changes in salinity, however, or changes of long duration or magnitude, may upset the equilibrium between organisms and their environment. Abnormal periods of freshwater inflow (i.e., floods and droughts) may alter salinities sufficiently to cause widespread damage to the ecosystem.

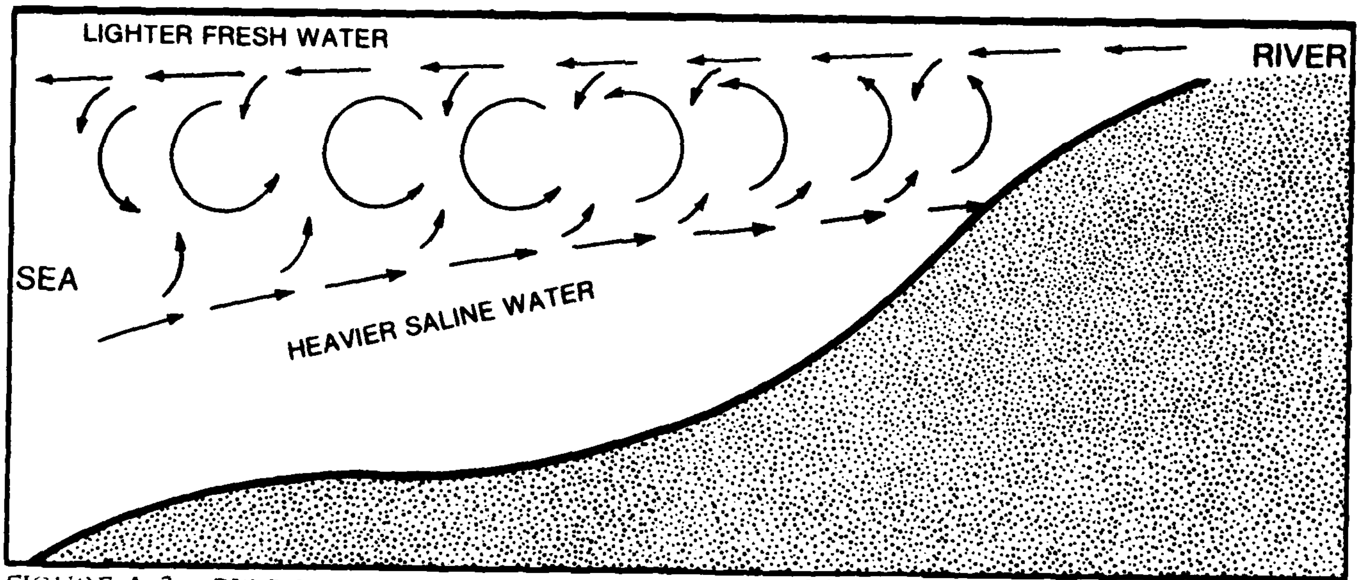


FIGURE A-3 CIRCULATION IN A PARTIALLY MIXED ESTUARY

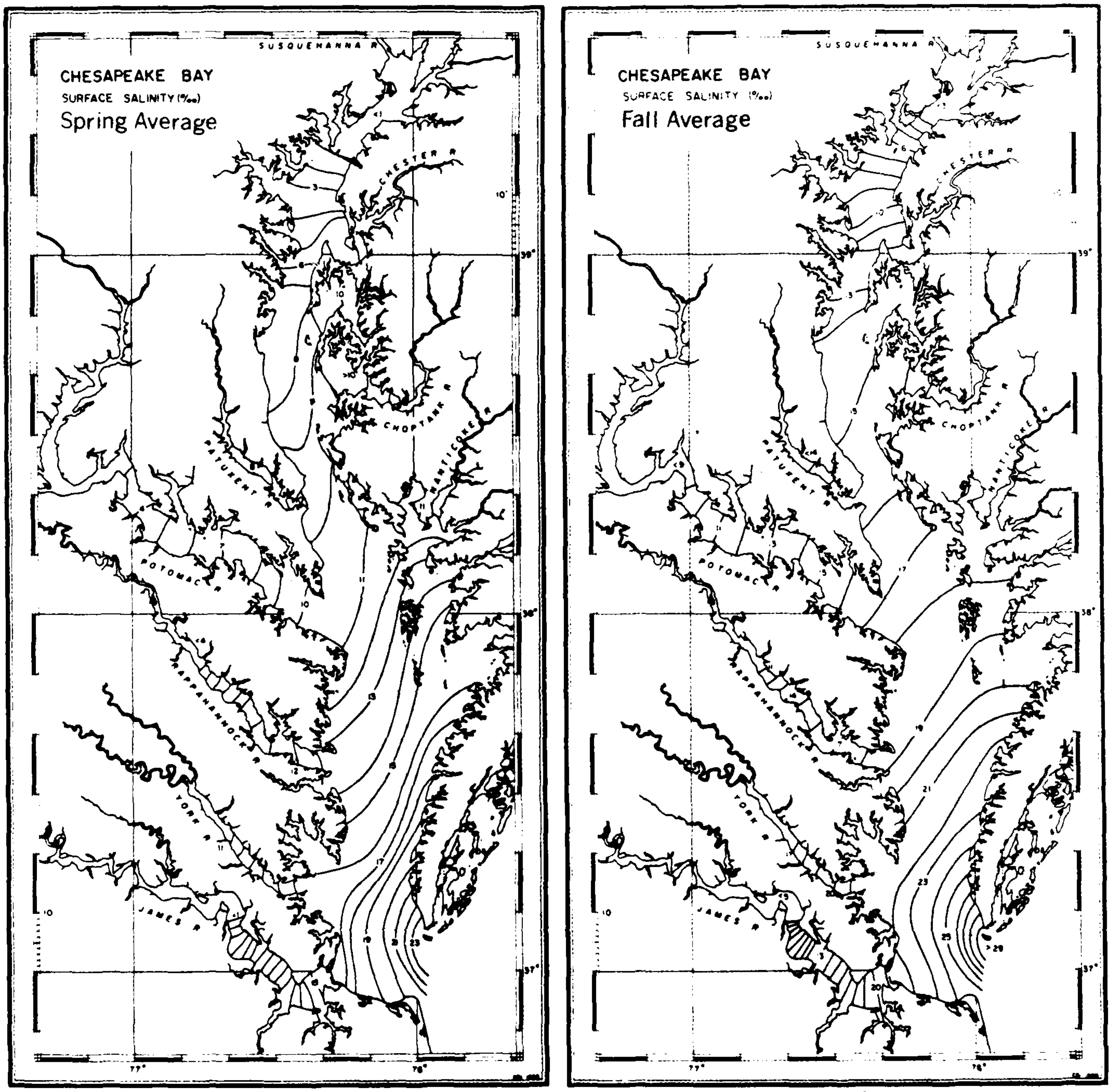


FIGURE A-4 GEOGRAPHICAL AND SEASONAL VARIATIONS IN SALINITIES IN CHESAPEAKE BAY

Dissolved oxygen is another important physical parameter. Dissolved oxygen levels vary considerably both seasonally and according to depth. During the winter the Bay is high in dissolved oxygen content since oxygen is more soluble in cold water than in warm. With spring and higher water temperatures, the dissolved oxygen content decreases. While warmer surface waters stay near saturation, in deeper waters the dissolved oxygen content becomes significantly less despite the cooler temperatures because of increasing oxygen demands (by bottom dwelling organisms and decaying organic material) and decreased vertical mixing. Through the summer, the waters below 30 feet become oxygen deficient. By early fall, as the surface waters cool and sink, vertical mixing takes place and the oxygen content at all depths begins to steadily increase until there is an almost uniform distribution of oxygen. While species vary in the level of dissolved oxygen they can withstand before respiration is affected, estuarine species in general can function in waters with dissolved oxygen levels as low as 1.0 to 2.0 mg/liter. Dissolved oxygen levels of about 5.0 mg/liter are generally considered necessary, however, to maintain a healthy environment over the long term.

The effects of temperature on the estuarine system are also extremely important. Since the waters of Chesapeake Bay are relatively shallow compared to the ocean, they are more affected by atmospheric temperature conditions. Generally speaking, the annual temperature range in Chesapeake Bay is between 0°C and 29°C. Because the mouth of the estuary is close to the sea, it has a relatively stable temperature as compared with the upper reaches. Some heat is required by all organisms for the functioning of bodily processes. These processes are restricted, however, to a particular temperature range. Temperatures above or below the critical range for a particular species can be fatal unless the organism is able to move out of the area. Temperature also causes variations in water density which plays a role in stratification and non-tidal circulation as discussed earlier.

Light is necessary for the survival of plants because of its role in photosynthesis. Turbidity, more than any other physical factor, determines the depth light will penetrate in an estuary. Turbidity is suspended material, mineral and/or organic in origin, which is transported through the estuary by wave action, tides, and currents. While the absence of light may be beneficial to some bottom dwelling organisms since they can come out during daylight hours and feed in relative safety, this condition limits the distribution of plant life because of the restriction of photosynthetic activity. This restriction of plant life (especially plankton in the open estuary) will reduce the benthic (i.e., bottom dwelling) and zooplankton populations which in turn will reduce fish productivity.

Nutrients are the minerals essential to the normal functioning of an organism. In Chesapeake Bay, important nutrients include nitrogen, phosphorus, carbon, iron, manganese, and potassium. It is generally believed that most of the nutrients required by estuarine organisms are present in sufficient quantity in Chesapeake Bay. Excesses of some nutrients are often a more important problem than deficiencies. Excesses of nitrogen and phosphorus, for example, may cause an increase in the rate of eutrophication which, in turn, can eliminate desirable species, encourage the growth of obnoxious algae, and cause low dissolved oxygen conditions from the decay of dead organisms and other materials. Relatively little is known about the quantities of specific nutrients necessary for the healthy functioning of individual species, or more importantly, of biological communities.

While it is necessary to keep in mind the interactions of these physical and chemical variables when studying Chesapeake Bay, these parameters should not and, in fact, cannot be addressed separately. The Bay ecosystem is characterized by the dynamic interplay between many complex factors. As a simple example, the levels of salinity and temperature will both affect the metabolism of an aquatic organism. In addition, both salinity and temperature can cause a drop in the oxygen concentration in the water and thus an increase in the required respiration rate of the organism. While it is true the effects of these variables individually may be of a non-critical nature, the combined (or synergistic) effects of the three stresses may be severe to the point of causing death. These three parameters, in turn, also interact with other physical and chemical variables such as pH, carbon dioxide levels, the availability of nutrients, and numerous others. The subtle variable of time may also become critical in many cases. The important point is that the physical and chemical environment provided by Chesapeake Bay to the indigenous biota is extremely complex and difficult, if not impossible, to completely understand.

THE BIOTA OF CHESAPEAKE BAY

The estuary is biologically a very special place. It is a very demanding environment because it is constantly changing. The resident plants and animals must be able to adjust to changes in physical and chemical parameters. The requirement for adjustment to the almost constant ecological stress limits the number of species of plants and animals that are able to survive and reproduce in the estuary. Despite the fact that relatively few species inhabit the Bay, the Chesapeake, like most estuaries, is an extremely productive ecosystem.

There are a number of reasons why estuaries are so productive. First, the circulation patterns in the area of mixing of lighter freshwater with heavier sea water in a partially mixed estuary such as Chesapeake Bay tend to create a "nutrient trap" which acts to retain and recirculate nutrients. Second, water movements in the estuary do a great deal of "work" removing wastes and transporting food and nutrients enabling many organisms to maintain a productive existence which does not require the expenditure of a great deal of energy for excretion and food gathering. Third, the recycling and retention of nutrients by bottom-dwelling organisms, the effects of deeply penetrating plant roots, and the constant formation of detrital material in the wetlands create a form of "self-enriching" system. Last, estuaries benefit from a diversity of producer plant types which together provide year-round energy to the system. Chesapeake Bay has all three types of producers that power the ecosystems of our world: macrophytes (marsh and sea grasses), benthic microphytes (algae which live on or near the bottom), and phytoplankton (minute floating plants).

AQUATIC PLANTS

As implied above, certain aquatic plants are critical to the health and productivity of Chesapeake Bay. Plants use sunlight and the inorganic nutrients in the water to produce the energy to drive the estuarine ecosystem. Thus, these plants, ranging from the microscopic algae to the larger rooted aquatics, are the primary producers-the first link in the aquatic food chain. Aquatic plants exist in the natural environment in a myriad of shapes, forms, and degree of specialization. They are also found in waters of widely varying physical and chemical quality.

"Phytoplankton" is a general term for aquatic plants of both fresh and saline waters which are characteristically free-floating and microscopic. The most important of the phytoplankton are the green algaes, diatoms, and dinoflagellates. The population of these organisms is represented by relatively few species, but when they do occur, they are present in tremendous numbers. Phytoplankton are the principal photosynthetic producers in the marine, estuarine, and freshwater environments, and will grow in the water column to any depth that light will penetrate. Blue-green algae are another type of phytoplankton organism which are not generally considered to be of importance in aquatic productivity, but are best known for the nuisance conditions caused when their growth occurs in excess. Huge populations, or blooms, of these organisms located near the surface of the water reduce the sunlight available to bottom-dwelling organisms. The blooms can also give off objectionable odors, clog industrial and municipal water intakes, and generally cause nuisance conditions.

Macrophytes are, as the Greek roots of the word indicate, "large plants." Unlike the freely floating, or only weakly motile, and minute phytoplankton, the macrophytic aquatic plants are generally either rooted or otherwise fastened in some manner to the bottom. Most have defined leaflets which grow either entirely submerged, floating on the surface of the water, or out of the water with leaf surfaces in direct contact with the atmosphere.

The distribution of macrophytes ranges from entirely freshwater to the open ocean. These types of plants are not only important as food and habitat for fish and wildlife, but they are also important in the recovery of nutrients from deep sediments.

The "Biota" section of the Chesapeake Bay Existing Conditions Report and Appendices 14 and 15 of the Chesapeake Bay Future Conditions Report include a more detailed discussion of aquatic plants - their types and distribution, importance in the ecosystem, and the problems associated with them.

FISH AND WILDLIFE

The energy supplied to the ecosystem by the green plants of the Bay must be made available in some manner to the meat-eating predators, including man, which are higher in the food chain. This vital link is filled by many different varieties of organisms such as zooplankton and various species of worms, shellfish, crabs, and finfish. Zooplankton include small crustaceans such as copepods, the larva of most of the estuarine fishes and shellfishes, several shrimp-like species, and other animal forms that generally float with the currents and tides. Phytoplankton and plant detritus (along with adsorbed bacteria, fungi, protozoa, and micro-algae) are consumed directly by the zooplankton and other larger aquatic species.

If man through his activity interrupts an established energy flow in the environment, he may cause energy losses to the system as well as other detrimental biological effects. Man's activities, for example, may cause the loss of a detritus producing area (e.g., a stand of saltmarsh cordgrass) resulting in a decline of the organisms which primarily feed on detritus. A loss of this nature directly affects the next higher trophic level, thereby starting a chain reaction throughout the food web. Generally, in estuaries, there is a great deal of dependence of larger organisms on a few key smaller organisms that utilize detritus and micro-algae for food.

Like the aquatic plant communities, the aquatic animal communities are not spread homogeneously throughout the Bay. Although the entire estuary serves as nursery and primary habitat for finfish, spawning areas are concentrated in the areas of low salinity and freshwater in the Upper Bay and corresponding portions of the major tributaries. The northern part of Chesapeake Bay, including the Chesapeake and Delaware Canal, is probably the largest of all spawning areas in the Bay. This area plus the upper portions of the Potomac, York, Rappahannock, James, and Patuxent Rivers, represent about 90 percent of the anadromous fish (i.e., those which ascend rivers from the sea to reproduce) spawning grounds in the Chesapeake Bay Region. The Bay serves as a spawning and nursery ground for fish caught from Maine to North Carolina. Some of the fish that use the Bay as a nursery include striped bass, weakfish, shad, alewife, blueback herring, croaker, menhaden, and kingfish.

Oysters are abundant in many parts of the estuary. The numerous small bays, coves, and inlets between the Chester and Nanticoke Rivers along the Eastern Shore and the lower portions of the Patuxent, Potomac, York, Rappahannock, and James Rivers account for approximately 90 percent of the annual harvest of oysters.

Some species of Chesapeake Bay fish and shellfish thrive in the saltier waters of the estuary. The mouth of the Chesapeake, an area of high salinity, is the major blue crab spawning area in the Bay and its tributaries.

In addition to Chesapeake Bay's large resources of finfish and shellfish, the marshes and woodlands in the area provide many thousands of acres of natural habitat for a variety of waterfowl, other birds, reptiles, amphibians, and mammals.

Chesapeake Bay is the constricted neck in the gigantic funnel pattern that forms the Atlantic Flyway. Most of the waterfowl reared in the area between the western shore of Hudson Bay and Greenland spend some time in the marshes of the Bay and its tributaries during their migrations. Good wintering areas adjacent to preferred upland feeding grounds attract more than 75 percent of the wintering population of Atlantic Flyway Canada geese. The marshes and grain fields of the Delmarva Peninsula are particularly attractive to Canada geese and grain-feeding swans, mallards, and black ducks. The Susquehanna Flats, located at the head of the Bay, supports huge flocks of American widgeon in the early fall, while several species of diving ducks, including canvasback, redhead, ringneck, and scaup, winter throughout Chesapeake Bay. About half of the 80,000 whistling swans in North America winter on the small estuaries in or around the Bay. While the Chesapeake is primarily a wintering ground for birds that nest further north, several species of waterfowl, including the black duck, blue-winged teal, and wood duck, find suitable nesting and brood-raising habitat in the Bay Region.

In addition to waterfowl, many other species of birds are found in the Study Area. Some rely primarily on wetlands for their food and other habitat requirements. These include rails, various sparrows, marsh wrens, red-winged blackbirds, snipe, sandpipers, plovers, marsh hawk, shorteared owl, herons, egrets, gulls, terns, oyster catcher, and curlews. Many of the above species are insectivores, feeding on grasshoppers, caterpillars, beetles, flies, and mosquitoes, while others feed on seeds, frogs, snakes, fish, and shellfish. There are numerous other birds which rely more heavily on the wooded uplands and agricultural lands for providing their basic habitat and food requirements. Among these species are many game birds, including wild turkey, mourning dove, bobwhite quail,

woodcock, and pheasant. It should be emphasized that some of these species require both an upland and a wetland habitat. Modest populations of ospreys and American bald eagles also inhabit the Bay Region.

The Chesapeake Bay Region is also home for most of the common mammals which are native to the coastal Mid-Atlantic Region. The interspersion of forest and farmland and the proximity of shore and wetland areas form the basis for a great variety of ecological systems. The abundance of food such as mast and grain crops and the high quality cover vegetation found on the wooded uplands and agricultural lands support good populations of white-tailed deer, cottontail rabbit, red fox, gray fox, gray squirrel, woodchuck, opossum, and skunk. The various vegetation types found in wetland areas provide indispensible natural habitat requirements for beaver, otter, mink, muskrat, marsh rabbit, and nutria. In addition, there are numerous species of small mammals, reptiles, and amphibians which inhabit the Study Area and are integral parts of both the upland and wetland food cycles.

IMPORTANT PLANT AND ANIMAL ORGANISMS

As part of the work done for the Future Conditions Report, a survey of prominent Bay Area scientists was conducted to determine the most important plant and animal species based on economic, biological, and social criteria. For example, a species would qualify as an "important species" if it were either a commercial species, a species pursued for sport, a prominent species important for energy transfer to organisms higher in the food chain, a mammal or bird protected by Federal law, or if it exerted a deleterious influence on other species important to man. The common names of the 124 species and genera identified according to these criteria are present in Table A-2.

PLANT AND ANIMAL COMMUNITIES

Although the plants and animals of Chesapeake Bay have been treated separately in the previous discussion, in the real world they are inextricably bound together in communities. Bay communities are important because of the complex interactions between inhabiting organisms, both plant and animal, and between one community and another. In the "eelgrass" community, for example, the organic detritus formed by eelgrass, plus the microorganisms adsorbed on it, represent the main energy source for animals living in the community and for animals outside the community to which detritus is transported. In addition, eelgrass performs the following physical and biological functions:

1. It provides a habitat for a wide variety of organisms.

2. It is utilized as a nursery ground by fish.

3. It is a food source for ducks and brant.

4. The plant physically acts as a stabilizing factor for bottom sediments, which allows greater animal diversity.

5. It plays a role in reducing turbidity and erosion in coastal bays.

TABLE A-2
IMPORTANT CHESAPEAKE BAY PLANT AND ANIMAL ORGANISMS

Algae

Blue-Green Alga
** Diatom (4 general)
Dinoflagellate (3 species)
Sea lettuce
Green alga
Red alga

Vascular Plants (Marsh and aquatic)

* Widgeongrass
Saltmarsh Cordgrass
Eelgrass
Horned pondweed
Wild rice
Cattails
Pondweeds
Arrow-arum
Wild celery

Cnidaria

* Stinging nettle
** Hydroid

Ctenophora (comb jellies)

Comb jelly (2 species)

Platyhelminthes (flatworms)

Flatworm

Annelida (Worms)

** Bloodworm
Clam worm
Polychaete worm (4 gener)
Oligochaete worm

Mollusca (Shellfish)

Eelgrass snail
Oyster drill
Marsh periwinkle
Hooked mussel
Ribbed mussel
Oyster
Hard shell clam

Mollusca (Shellfish) (Cont.)

** Coot clam
** Brackish water clam
Balthic macoma
Stout razor clam
Razor clam
* Soft shell clam
Asiatic clam

Arthropoda (Crabs), shrimp, and other crustaceans)

Barnacle
* Copepod (2 genera)
Opposum shrimp
Cumacean
Isopod (2 species)
Amphipod (5 genera)
Sand flea
** Grass shrimp
** Sand shrimp
** Xanthid crab (2 species)
Blue crab

Urochordata

Sea squirt

Pisces (Fish)

Cownose ray
Eel
** Shad, herring
Menhaden
Anchovy
Variegated minnow
Catfish, bullheads
Hogchoker
** Killifish
Silverside
** White perch
Striped bass
Black sea bass
Weakfish
** Spot
Blenny
Goby
Harvestfish
Flounder

Pisces (Fish) (Cont.)

** Northern puffer
Oyster toadfish

Reptiles

** Snapping turtle
** Diamond-backed terrapin

Aves (Birds)

Horned grebe
Cattle egret
Great blue heron
Glossy ibis
** Whistling swan
** Canada goose
Wood duck
** Black duck
Canvasback
Lesser scaup
** Bufflehead
** Osprey
Clapper rail
Virginia rail
American coot
American woodcock
Common snipe
Semipalmated sandpiper
Laughing gull
Herring gull
Great black-backed gull
Forster's tern
Least tern

Mammalia (Mammals)

Beaver
Muskrat
Mink
Otter
Raccoon
White-tailed deer

Endangered Species

Shortnose sturgeon
Atlantic sturgeon
Maryland darter
Southern bald eagle
American peregrine falcon
Ipswich sparrow
Delmarva fox squirrel

* Life histories discussed in the "Biota" Chapter of the Chesapeake Bay Existing Conditions Report.

** Life histories discussed in the "Biota" Appendix of the Chesapeake Bay Future Conditions Report.

Appendix 15 of the Future Conditions Report presents more detailed information on the eelgrass community as well as the "oyster" community, two of the most important in the Chesapeake Bay system.

It is evident from the preceding discussion that Chesapeake Bay is an almost incomprehensibly complex physical and biological system. When the human element is added, the complexities and interrelationships become even more involved.

SOCIO-ECONOMIC CHARACTERISTICS OF THE STUDY AREA

INTRODUCTION

Perhaps the most changeable element of the Chesapeake Bay Region is its people. Populations grow and change over time as do the economic activities of the people. Likewise, our ability to measure, describe and forecast these changes also evolves over time. Since the study was authorized in 1965 until the preparation of this report, the population of the Bay Region has grown and changed significantly. Demographic and economic base data have been revised and updated several times most notably by the decennial censuses of 1970 and 1980. Forecasts of future growth are revised continuously as new or additional information becomes available or as a result of advances in the state-of-the-art.

The analyses of this study have taken place over parts of three decades. Each analysis was done with the most current data and forecasts available at the time. Because of the duration of the study, the basic data set or forecast parameters have varied from analysis-to-analysis depending on the time at which the study was conducted. This summary will present the data which formed the basis for various assumptions and analyses critical to the study's conclusions and recommendations. The data and discussion which follow are taken from the Chesapeake Bay Future Conditions Report of 1978 with the addition of a brief discussion of the 1980 OBERS BEA Regional Projections.

THE PEOPLE

POPULATION CHARACTERISTICS

When Captain John Smith first explored the Chesapeake in 1608, it was an estuary which had yet to feel the impact of man to any significant extent. But, even before Captain Smith's voyage, people had settled on the shores of the Bay drawn by its plentiful supplies of fish and game. These settlements were inhabited by Assateagues, Nanticoke, Susquehannock, and Choptank Indians. It was the Indian that provided the names for many promontories of land and water courses. The relatively few wastes generated by the Indians were easily assimilated by the natural cleansing action of the Bay and its tributaries. Later, more and more people moved into the Bay Region, attracted first by a soil and climate favorable to the growth of tobacco, and later by the development of major manufacturing and transportation centers as well as the founding of the Nation's Capital at Washington, D.C. By 1980, 372 years after Captain Smith's voyage up the Bay, there were over 9 million people living in the Bay Region.

During Colonial times, the Chesapeake Bay Region was one of the primary growth centers of the New World. However, after the decline of the Region's tobacco industry in the 19th century, population growth began to lag. This period of relative stagnation lasted until World War II when large increases in Federal spending (especially on defense)

stimulated employment and population growth within all the economic subregions. As shown in Table A-3, the areas around Washington, D.C. and Norfolk, Virginia, experienced especially high rates of growth after World War II. Over half of the total population growth in the Bay Region between the time of the Jamestown settlement to the present occurred during the 1940-1970 period. Population in the Region has increased since the 1970 Census at an annual rate of approximately one and one-eighth percent to the estimated total in 1974 of 8.2 million. While this rate is considerably less than the average annual rate of 2.5 percent experienced during the 1940-1970 period, it was still higher than the National rate of approximately 1 percent annually during the 1970-1974 period.

TABLE A-3
POPULATION GROWTH IN THE CHESAPEAKE BAY STUDY AREA

Study Area Portions of BEA Economic Regions	1940 Population	1970 Population	Absolute Change	Percentage Change
Baltimore, Maryland	1,481,179	2,481,402	+ 1,000,223	+ 67.5
Washington, D.C.	1,086,262	3,040,371	+ 1,954,109	+ 179.9
Richmond, Virginia	437,103	728,946	+ 291,843	+ 66.8
Norfolk-Portsmouth, VA	467,229	1,121,856	+ 654,627	+ 140.1
Wilmington, Del. SMSA	248,243	499,493	+ 251,250	+ 101.2
Total Study Area	3,720,016	7,872,068	+ 4,152,052	$ 111.6
Total United States	132,165,129	203,211,926	+71,046,797	$ 53.8

Source: U.S. Census Data

The majority of the inhabitants of the Chesapeake Bay Region are concentrated in relatively small areas in and around the major cities. Approximately 90 percent of the population resided in one of the Region's seven Standard Metropolitan Statistical Areas (SMSA) in 1970. The number of urban dwellers increased by almost 1.5 million during the 1960-1970 decade, while the rural population remained virtually the same. People have tended to move out of the inner cities and rural counties and into the suburban counties. Thirty-five of the 76 counties and major independent cities in the area experienced a net out-migration during the 1960-1970 period. On the other hand, most of the suburban counties experienced growth rates in excess of 30 percent and in-migrations of at least 10 percent of their 1960 population. In the Bay Region as a whole, net in-migration accounted for about one-third of the 1.5 million increase in population during the decade of the 1960's. Most of this in-migration was in response to large increases in employment opportunities in the Bay Region.

In 1970, there were approximately 3.3 million people employed in the Study Area. About 91 percent of these worked in one of the Region's seven SMSA's. During the 1960-1970 period, total employment increased by about three-quarters of a million jobs or approximately 30 percent. The National gain during the same period was 19.5 percent.

Compared to the Nation as a whole, the Bay Region has a lower proportion of workers in the blue-collar industries, such as manufacturing and mining, and a higher proportion in the white-collar industries, such as public administration and services. Since employment in the white-collar industries tends to be less volatile, the Study Area has had consistently lower unemployment rates over the last several decades than the Nation as a whole. Also contributing to these relatively stable employment levels are the large

numbers of workers whose jobs depended on relatively consistent Federal government spending.

Per capita income in the Study Area was $3,694 in 1969, which was about 9 percent higher than the National figure. Median family income levels ranged from $16,710 in Montgomery County, Maryland, (one of the highest in the Nation), to $4,778 in Northampton County, Virginia. As shown in Table A-4 there was a significantly higher proportion of families in the over $15,000 income bracket and fewer families whose incomes were below the poverty level in the Study Area than in the Nation.

TABLE A-4
FAMILY INCOME DISTRIBUTION FOR THE CHESAPEAKE BAY STUDY AREA AND THE UNITED STATES, 1969

	Percent Below Poverty Level	"Middle" Income Families	Percent Above $15,000
Study Area	11.2	61.3	27.5
United States	12.2	68.6	19.2

ECONOMIC SECTORS

Manufacturing

Generally speaking, the Chesapeake Bay Region has a lower proportion of its workers employed in heavy water-impacting industries than in the Nation as a whole (see Figure A-5). For example, manufacturing activities in the Bay Region employed some 524,000 workers in 1970, or about 16 percent of the total employment in the Study Area. This figure was significantly lower than the National figure of approximately 25 percent. In addition, manufacturing employment in the Bay Region grew by 6 percent during the 1960-1970 period, which was well below the National growth rate of 13 percent.

Despite the fact that the manufacturing sector was not as important to the economy of the Study Area as in the Nation as a whole, this sector still has a great deal of significance. First, the navigation channels in Chesapeake Bay are used by many area manufacturers as a means of shipping raw materials to their factories and finished products to market. Second, many manufacturing firms use water in their production process, usually for cleaning or cooling purposes. This water is often returned to the Bay system untreated or only partially treated.

As Figure A-6 indicates, in addition to the fact that there is a relatively low proportion of workers in manufacturing in the Bay Region, the majority of the manufacturing industries which are located in the area are not considered to be major water users (i.e., chemicals, pulp and paper, metals, petroleum refining, and food and kindred products). The heavy water users that do exist are generally concentrated in the Upper Bay around Baltimore and in the Wilmington, Delaware SMSA. Employment in the chemical and metal industries is centered around Baltimore, Wilmington, and Richmond. Food and kindred products employment is concentrated on the Eastern Shore, in the Washington SMSA, and in Norfolk. The only major pulp and paper mill in the Bay Region is located at West Point, Virginia. There is also currently only one major petroleum refinery in the Region (Yorktown, Virginia). Other significant concentrations of manufacturing

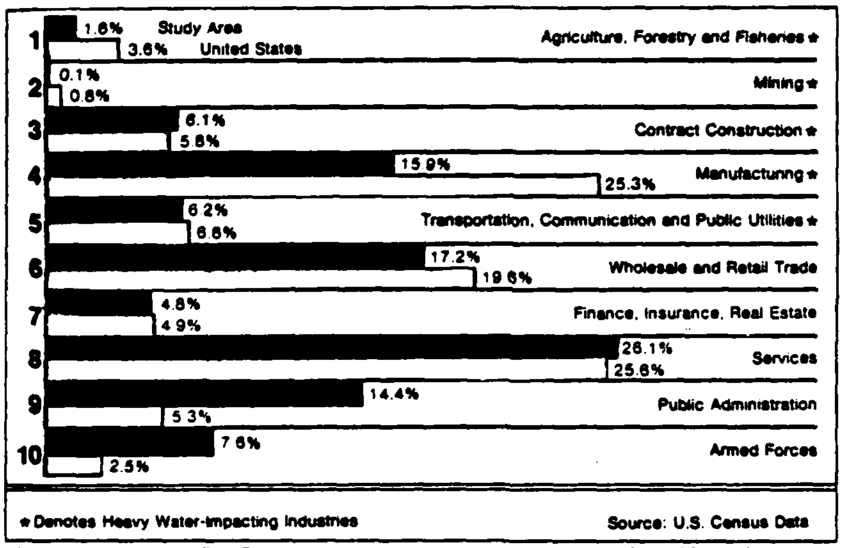
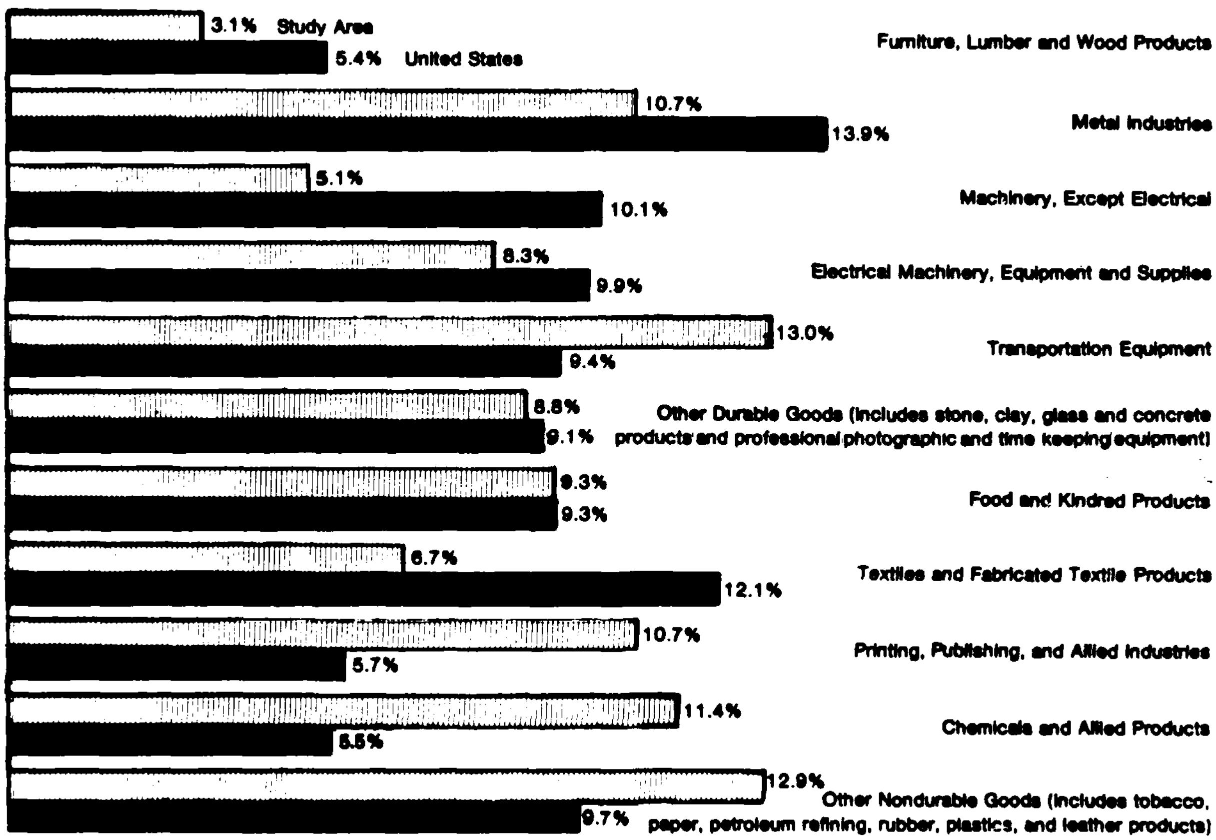


FIGURE A-5 EMPLOYMENT BY ECONOMIC SECTORS, CHESAPEAKE BAY STUDY AREA AND UNITED STATES, 1970



Source: U.S. Census of Population: 1970, "General Social and Economic Characteristics."

FIGURE A-6 MANUFACTURING EMPLOYMENT FOR THE CHESAPEAKE BAY STUDY AREA AND THE UNITED STATES, 1970

industries are: printing and publishing, the two machinery shops in the Washington area, transportation equipment around Norfolk-Portsmouth, and tobacco processing in the Richmond SMSA. A more detailed discussion of industrial activity in the Bay Region is provided in Appendix 3 - "Economic and Social Profile" of the Future Conditions Report.

Public Administration

The public administration sector, which includes civilian workers in the Federal, state, and local governments, is extremely important to the economy of the Bay Region. In 1970, this sector employed approximately 475,000 people or about 14 percent of the total workers. This is significantly higher than the National average of 5 percent. Employment in this sector grew 36 percent during the 1960 - 1970 decade, very close to the 37 percent rate of growth for the Nation.

Although the public administration sector ranked only fourth in the total employment in the Study Area, the sector is far more important to the Region's economy than these employment figures indicate. First, earnings are higher than average in this sector. This has helped to stimulate other sectors of the economy, especially the retail trade and service industries. Second, the Federal portion of the public administration sector can be thought of as a "basic" industry since it exports its "product" (public services) to the entire Nation, thereby, bringing money into the Region and creating jobs.

The bulk of the total public administration employment in the Study Area (almost 66 percent) is located in the Washington, D.C. area. Other concentrations of workers are in the Richmond, Virginia, vicinity, throughout much of the Baltimore, Maryland SMSA, and in the Norfolk-Portsmouth area.

The public administration sector can be considered a "clean" industry from a water resources viewpoint. There are no special requirements for water for either processing or transportation purposes. However, fast-growing industries, such as the public administration sector, with its tremendous drawing capacity for workers and their families, can often cause rates of population growth that tax the ability of local government to provide services such as water supply and sewerage.

Agriculture

Although less than 2 percent of the total workers in the Chesapeake Bay Region are employed in the agricultural sector (i.e., the actual planting, cultivation, and harvesting of raw agricultural goods), these activities have a great deal of impact on the area's economy and water and land resources. In 1969 the value of all farm products sold by commercial farms in the Bay Region was approximately $589 million. Approximately 87 percent of the developed land in the Bay Region is used for agricultural purposes. Poor farming techniques, both in the past and present, have resulted in the extensive erosion of valuable soils which, in turn, has caused the siltation of many of the Bay's waterways. Run-off from fields sprayed with chemical fertilizers adds large quantities of nutrients to the waterways. This practice has resulted in an increase in the amounts of undesirable algae and other vegetation in some waters, thereby decreasing the amounts of available oxygen in the water and, in extreme cases, causing fish kills. In addition, the use of insecticides in agricultural areas has caused in the past significant damage to fish and wildlife populations in the Bay Region.

Fisheries

Just as the Indians and early settlers harvested the Bay's plentiful supplies of finfish, shellfish, and crabs, modern day watermen harvest and market large quantities of the Chesapeake's living treasures. In 1973, commercial landings of shellfish and finfish totaled 565 million pounds with a value at the dock of approximately $47.9 million. This catch amounted to an average of 200 pounds per surface acre of water. In addition, sport landings of finfish and shellfish in recent years have been estimated to be as large as the commercial catch for some species. However, even when the value of the sports fishing catch is added to the commercial catch value, the total is a very small percentage of the value of agricultural products, for example, and almost negligible when compared to value added in the manufacturing sector. On the other hand, the fisheries and watermen of Chesapeake Bay add a generous amount of regional color and tradition to the "way of life" in the Bay Region. These benefits are difficult, if not impossible, to measure.

Because agricultural products and seafood are often perishable, they are usually processed in close proximity to where they are harvested. As a result, the agricultural and seafood harvesting sectors in the Bay Region support locally important food processing plants.

Armed Forces

Still another important source of employment for residents of the Bay Region is the Armed Forces. In 1970, there were approximately 250,000 members of the Armed Forces stationed within the Study Area, representing almost 8 percent of the total employment. This percentage was significantly higher than the National figure of 2.5 percent. The cities of Norfolk and Virginia Beach in the Hampton Roads area and Anne Arundel, Prince Georges, and Fairfax counties in the Baltimore and Washington, D.C., areas contained the largest numbers of military personnel.

Construction

The construction sector in the Bay Region employed approximately 200,000 people in 1970. Construction activities have had a great deal of impact on the water resources of the Bay Region. Much of the disturbed soil on construction sites becomes sediment in streams and rivers. This silt can adversely affect fish and wildlife populations, clog navigation channels, increase the costs of treatment for city and industrial water supplies, make water-based recreation less enjoyable, and generally lower the aesthetic quality of a waterway. Unfortunately, the areas in the Region with the most construction activity are the same areas in which there are already significant industrial and residential strains on the Bay.

Other Sectors

The remaining Bay Region workers, which account for more than one-half of the total, are employed in one of the following sectors:

1. Wholesale and retail trade.

2. Transportation, communications, and public utilities.

3. Finance, insurance, and real estate.

4. Services.

These jobs are generally "supportive" of the economic sectors discussed previously. With the exception of the transportation and public utilities sectors, they do not have a significant impact on the water resources of the Region. Many of these activities, however, exist in the Region because of the proximity of the Chesapeake Bay resource. For example, the Bay's land and water resources allow for the development of certain "regionally-unique" entertainment and recreation services which help to expand the service sector. These include such activities as private bathing beaches, pleasure and fishing boat rentals, and the operation of seafood restaurants serving regional specialities. Some of the other activities (e.g., finance, insurance, retail trade, real estate, and certain services) exist in the Bay Region because it is an area which is characterized by higher than average incomes and population growth rates. The location of the Nation's Capitol in the area also attracts many workers in these sectors due to the regulatory functions of the Federal Government and the desirability of companies in the regulated industries to maintain offices in the Washington area.

ECONOMIC AND DEMOGRAPHIC PROJECTIONS

OBERS Series C

The base projections used in the future needs analysis for most of the Appendices of the Future Conditions Report were based on the Series C OBERS projections of population, income, earnings, and manufacturing output prepared by the Department of Commerce and the Department of Agriculture. A special set of projections coinciding with the Chesapeake Bay Study Area and the subregions was prepared by the Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce. An explanation of the methodology used to prepare the OBERS projections and the special disaggregation by BEA is contained in Appendix 3, "An Economic and Social Profile." Figure A-7 illustrates the great potential for growth that lies in the Chesapeake Bay Region.

The bulk of the total population and employment growth (about 52 percent in each category) is expected to take place in the Study Area portion of the Washington, D.C. Economic Area. This area is projected to experience population and employment growth rates of about 143 percent during the 1970-2020 period. The Richmond subregion and the Wilmington SMSA are also expected to grow at a faster rate than the Study Area as a whole with rates of 113 percent and 123 percent, respectively. On the other hand, the Baltimore and Norfolk-Portsmouth subregions are projected to grow at significantly lower rates with figures of 85 percent and 45 percent.

Real per capita income in the Study Area is projected to remain slightly above the National average through the projection period. Table A-5 presents projections of population and per capita income by subregion.

One of the major driving forces behind the significant increases in population and income outlined above will be major increases in manufacturing output. As shown in Table A-6, manufacturing output in the Chesapeake Bay Region is expected to increase by 563 percent. However, the proportion of total output accounted for by the heavy water-

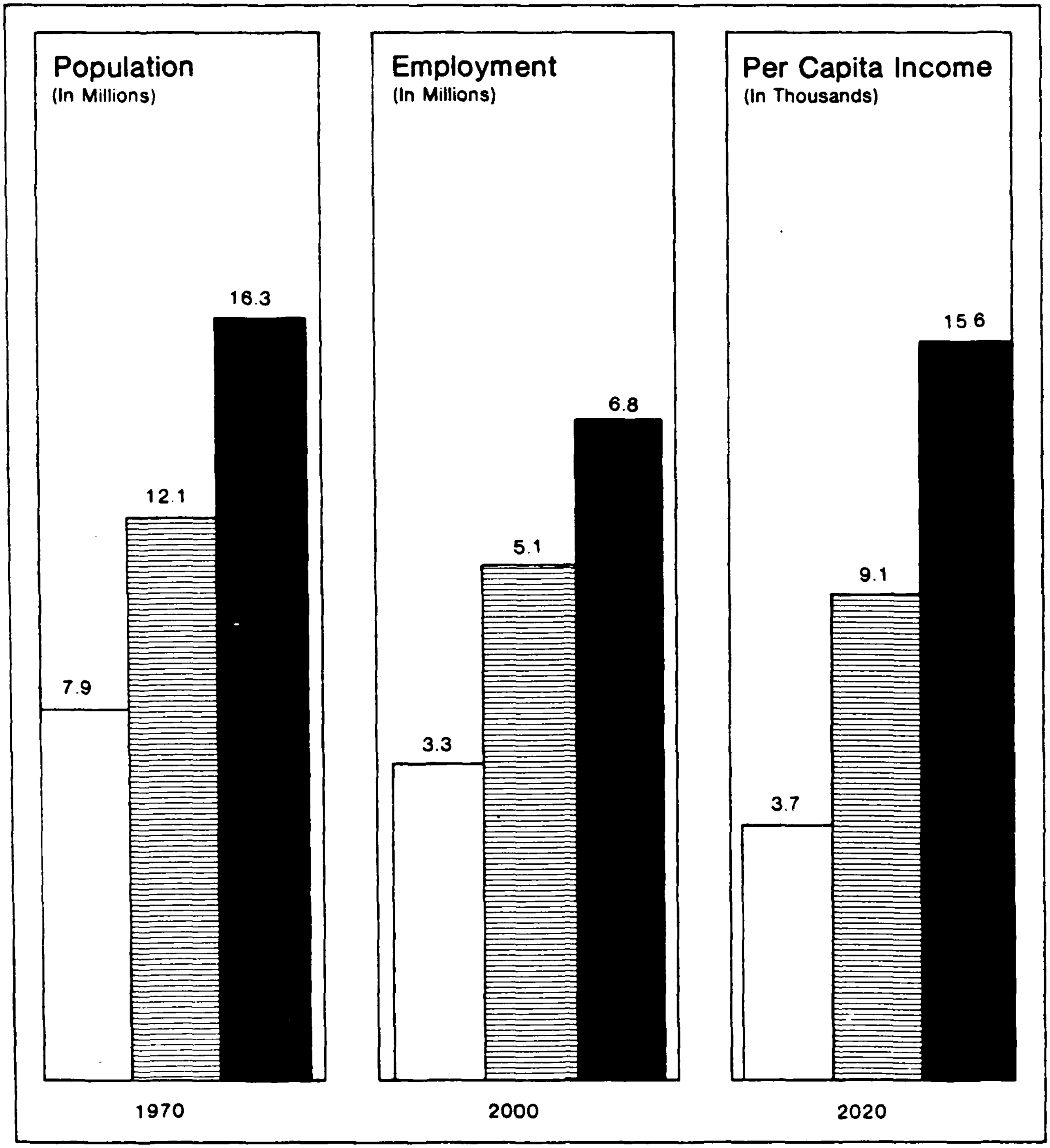


FIGURE A-7 POPULATION AND ECONOMIC PROJECTIONS FOR CHESAPEAKE BAY REGION TO 2020

TABLE A-5
SERIES C PROJECTIONS OF POPULATION, PER CAPITA INCOME, AND TOTAL PERSONAL INCOME BY SUBREGION (IN CONSTANT 1967 DOLLARS)

	1969		1980		2000		2020	
	Population	Per Capita Income	Population (% Increase)[1]	Per Capita Income (% Increase)	Population (% Increase)	Per Capita Income (% Increase)	Population (% Increase)	Per Capita Income (% Increase)
Baltimore, Md.	2,463.3	$3,579	2,877.6	$4,912	3,714.0	$8,556	4,596.3	$14,769
Washington, D.C.	2,985.5	3,977	3,695.0 (23.76)	5,653 (42.1)	5,314.3 (78.0)	9,534 (139.7)	7,397.2 (144.4)	15,612 (292.6)
Richmond, Va	727.5	3,454	871.8 (19.8)	4,828 (39.8)	1,180.1 (62.2)	8,290 (140.0)	1,555.0 (113.7)	14,184 (310.7)
Norfolk-Portsmouth, Va.	1,107.6	3,046	1,216.0 (9.8)	4,331 (42.2)	1,429.6 (29.1)	7,615 (150.0)	1,656.4 (49.6)	13,186 (332.9)
Wilmington, Del. SMSA	492.1	4,169	612.5 (24.7)	5,804 (39.2)	851.4 (73.0)	9,634 (131.0)	1,115.7 (126.7)	16,142 (287.2)
Study Area Total	7,776.0	$3,682	9,272.9 (19.3)	$5,182 (40.7)	12,489.4 (60.6)	$8,913 (142.1)	16,320.6 (109.9)	$15,030 (308.2)

[1] All percentage changes are calculated from 1969.

TABLE A-6
MANUFACTURING OUTPUT FOR CHESAPEAKE BAY REGION (IN MILLIONS OF 1967 DOLLARS)
BY INDUSTRY

	1969	2000		2020	
	Output (1)	Output	Percent Increase (2)	Output	Percent Increase (2)
Lumber and Wood Products	154.8	433.4	180.0	807.4	421.6
Metals	977.4	2,279.9	133.3	4,095.0	319.0
Machinery, Except Electrical	233.0	835.8	258.7	1,885.9	709.4
Electrical Machinery	331.3	1,595.5	381.6	4,092.6	1,135.3
Transportation Equipment	815.1	2,534.4	210.9	4,979.7	510.9
Petroleum Refining	57.3	165.4	188.6	301.2	425.6
Food and Kindred Products	747.4	1,795.1	140.2	3,150.4	321.5
Textiles and Textile Products	229.8	657.4	186.0	1,230.3	435.4
Printing and Publishing	445.2	1,428.3	220.8	2,930.8	558.3
Chemicals	1,856.4	6,989.8	276.5	15,298.5	724.1
Paper and Allied Products	215.6	712.5	230.5	1,549.7	618.8
Other Manufacturing	719.3	2,207.7	206.9	4,614.2	541.5
TOTAL	6,782.6	21,635.2	219.0	44,935.7	562.5

(1) Output in the form of "gross product originating" which is defined as that portion of GNP originating in a specific industry.

(2) Percent change measured from base year (1969).

impacting industries as a group (i.e., metals, petroleum refining, food and kindred products, chemicals, and paper and allied products) is expected to decline slightly from 56.8 percent in 1969 to 54.3 percent in 2020. In addition, the manufacturing sector is expected to continue to account for a significantly lower portion of total employment and income in the Bay Region than in the United States.

OBERS Series E

Since the initiation of the future conditions phase of the Chesapeake Bay Study, another set of baseline projections derived from more recent economic and demographic data was prepared and released by BEA. These new projections, called the "Series E" OBERS projections, must be considered by all Federal agencies engaged in water resource planning as directed by the Water Resource Council. The basic differences between the assumptions made in preparing the Series C and Series E projections are shown in Table A-7 and are discussed in more detail in Appendix 3 of the Future Conditions Report. The Series E population projection of 14.1 million people for the total Study Area in the year 2020 is appproximately 13.5 percent less than the Series C estimate for the same year. The Series E projections for the Study Area for 1980 and 2000 are also lower than the Series C projections for the same years by 4.5 percent and 7.3 percent, respectively. In addition, the Series E population projections for almost all the subregions are lower than the comparable Series C projections.

Estimates of 1975 population by county prepared by the U.S. Bureau of the Census allowed a comparison of actual population trends in the Chesapeake Bay Study Area with those trends that would be expected under the Series C and Series E OBERS projections. The 1975 population estimate for the entire Bay Region is approximately 370,000 less than the Series C and 162,000 less than Series E interpolated estimates. However, seven of the thirteen Study Area subregions had 1975 populations which were greater than either the Series C or Series E estimates. Much of the discrepancy in the total Bay Region estimates can be explained by a significant overestimate by both Series C and Series E of population growth in the Washington, D.C., SMSA. When population data for the Washington, D.C., SMSA is subtracted from the Bay Region totals, the remainder for the Region falls between the Series C and Series E estimates.

Based on the preceding analysis, it can be concluded that the applicability of estimates of future resource demands based on OBERS Series C or Series E baseline projections depends on the subregion of interest. It should be emphasized, however, that 1970-75 trends may not be indicative of trends to be expected during the entire 1970-2020 projection period.

Sensitivity Analysis

The most fundamental assumption made in preparing the projections of future demands on Chesapeake Bay presented in the Chesapeake Bay Future Conditions Report is that the Series C OBERS baseline projections of population, income, and manufacturing activity accurately reflect future trends in the Chesapeake Bay Region. In order to evaluate the impact on the resource of the Series E baseline projections, a "Sensitivity Analysis" section dealing with each resource use activity was prepared. This section presented future demands based on Series E baseline projections which could be compared to the Series C based projections of future demands. In addition, the sensitivity of future demands to changes in other parameters critical to the projection methodology was also evaluated. The findings of these analyses are discussed in detail in

TABLE A-7
A COMPARISON OF OBERS SERIES C AND SERIES E PROJECTIONS

Item	Series C	Series E
Growth of Population	Fertility rate of 2,800 children per 1,000 women	Gradual decline of fertility rate from 2,800 to the "replacement fertility rate" of 2,100 children per 1,000 women.
Military Establishment	Projects a decline to 2.07 million people by 1975 and thereafter a constant.	Projects a decline to 1.57 million persons by 1975 and thereafter a constant (due to smaller military establishment and the resultant smaller need for equipment and supplies a significantly slow rate of growth in the defense-related manufacturing industries is anticipated).
Hours Worked Per Year	Hours worked per employee per year are projected to decline at 0.25 percent per year.	Hours worked per employee per year are projected to decline at 0.35 percent per year.
Product Per Man-Hour	Projected to increase 3.0 percent per year.	Projected to increase 2.9 percent per year.
Earnings Per Man-Hour	Earnings per worker in the individual industries at the National level are projected to converge toward the combined rate for all industries more slowly in the Series E projections than in the Series C projections.	
Employed Population	Projected to increase from 40 to 41 percent of the total population.	Projected to be between 43 and 45 percent of the total population (higher percentages with the E Series reflects expected higher participation rates by women).

the appropriate appendices of the Future Conditions Report. Table A-8 compares population and employment projections for Series C and Series E for the Study Area.

1980 OBERS

Since completion of the future conditions phase of the Chesapeake Bay Study and the low freshwater inflow analysis (which was based on OBERS Series E), a new set of baseline projections have been released by BEA. These new projections are called 1980 OBERS BEA Regional Projections. These projections were not used in any of the Bay study analyses, consequently, they will not be discussed in detail here. In general, these projections show lower growth rates for the Region's population, but a larger percentage of that population will be employed.

Table A-9 shows a comparison of population and employment for the three sets of projections discussed above. The trend in the projections has been toward more conservative estimates of population employed. To the extent that results of Bay study analyses are dependent upon population projections and 1980 OBERS Projections are now the most accurate, it should be noted that these results are still valid, but may not be realized until later than originally expected. For example, the Series C 1980 population projection for the Bay Region is 19.7 million. This population would not be reached until about 2013 according to 1980 OBERS projections. The Series E 1980 population projection 18.9 million would be reached by about 1997 according to 1980 OBERS projections.

LAND USE

The development of the land in the Chesapeake Bay Region began when the first group of Indians wandered into the area thousands of years ago and established a village. Since then virtually all of the vast expanse of virgin forest which existed at that time and thousands of acres of wetlands have been cut, drained, or filled by more recent settlers. The original purpose of this development was to provide land for the cultivation of tobacco and wheat. High tobacco and wheat prices created an almost insatiable demand for land. As the productivity of the soil decreased after producing several years of crops, the land was abandoned and new land was cleared. The abandoned land returned to woodlands. During the nineteenth and twentieth centuries, factories, residences, port facilities, commercial establishments, and other physical manifestations of an increasingly industrialized society replaced many of the agricultural lands and second-growth woodlands. The following sections present a discussion of existing and future land use and related problems, as well as some alternative means of satisfying the identified needs.

EXISTING LAND USE

For the purposes of this study existing land use information for the Chesapeake Bay area was developed using remote sensing data obtained from high altitude aerial photography taken in 1970. These data were supplied by the U. S. Geological Survey (USGS) and are part of the Central Atlantic Regional Ecological Test Site (CARETS) project. Plates in Appendix 4 Water-Related Land Resources of the Future Conditions Report show the type and general distribution of the major land use activities in the area covered by the CARETS project (about 95 percent of the "Bay Region"). Based on the CARETS data, estimates of land use in the Chesapeake Bay Region were developed. These are presented in Figure A-8.

TABLE A-8
A COMPARISON OF SERIES C AND SERIES E OBERS PROJECTIONS
OF POPULATION AND TOTAL EMPLOYMENT FOR THE STUDY AREA*

REGION/PROJECTION TYPE	1980 SERIES C	1980 SERIES E	1980 % Difference	2000 SERIES C	2000 SERIES E	2000 % Difference	2020 SERIES C	2020 SERIES E	2020 % Difference
Study Area Portion of Economic Area 15									
Population	612,600	593,900	3.1%-	851,400	744,300	12.6%-	1,115,200	878,500	21.2%-
Total Employment	246,100	257,200	4.5%+	350,300	343,700	1.9%-	465,800	398,700	14.4%-
Study Area Portion of Economic Area 17									
Population	2,877,600	2,614,000	9.2%-	3,714,000	2,978,900	19.8%-	4,596,300	3,281,300	28.6%-
Total Employment	1,165,100	1,156,100	0.8%-	1,495,900	1,364,200	8.8%-	1,854,300	1,476,000	20.4%-
Study Area Portion of Economic Area 18									
Population	3,695,000	3,698,900	0.1%+	5,314,200	5,519,600	3.9%+	7,397,200	7,326,600	1.9%-
Total Employment	1,634,300	1,770,900	8.4%+	2,328,500	2,682,500	15.2%+	3,214,500	3,439,100	7.0%+
Study Area Portion of Economic Area 21									
Population	871,800	847,500	2.8%-	1180,100	1,051,700	10.9%-	1,555,100	1,199,500	22.9%-
Total Employment	360,200	381,000	5.8%+	477,100	484,600	1.5%+	619,900	538,200	13.2%-
Study Area Portion of Economic Area 22									
Population	1,216,100	1,121,600	7.8%-	1,429,700	1,279,800	10.5%-	1,656,400	1,441,500	13.0%-
Total Employment	498,600	496,000	0.5%-	581,200	582,000	0.1%+	670,600	647,400	3.5%-
Total Study Area Population	9,273,100	8,875,900	4.3%-	12,489,400	11,574,300	7.3%-	16,320,200	14,127,400	13.4%-
Total Employment	3,904,300	4,061,200	4.0%+	5,233,000	5,457,000	4.3%+	6,825,100	6,499,400	4.8%-

Comparison with 1980 OBERS was not possible for these geographic regions because 1980 OBERS projections have not been disaggregated to this level. * All figures rounded off to nearest hundred.

TABLE A-9
A COMPARISON OF SERIES C AND SERIES E OBERS PROJECTIONS
BY ECONOMIC AREA

BEA ECONOMIC AREA PROJECTION TYPE	1980 2/ SERIES C	1980 2/ SERIES E	1980 OBERS 3/	2000 SERIES C	2000 SERIES E	1980 OBERS 3/	2020 2/ SERIES C	2020 2/ SERIES E	1980 OBERS 3/
Philadelphia, Pa.									
Population	8,334,400	8,025,400	7,301,530	10,517,000	9,188,300	7,718,620	12,983,800	10,215,200	8,043,600
Total Employment	3,359,200	3,523,500	3,365,610	4,295,400	4,191,300	3,820,431	5,347,600	4,582,200	3,996,230
Harrisburg, Pa.									
Population	1,976,300	1,906,400	1,457,860	2,551,700	2,224,000	1,437,880	3,296,500	2,458,100	1,449,800
Total Employment	812,500	857,500	725,120	1,058,900	1,035,200	777,840	1,375,400	1,115,500	758,330
Baltimore, Md.									
Population	3,107,300	2,822,900	2,435,090	4,033,000	3,234,400	2,664,982	5,009,800	3,578,300	2,845,160
Total Employment	1,261,700	1,252,600	1,151,420	1,626,000	1,482,800	1,330,573	2,021,100	1,609,600	1,350,900
Washington, D.C.-Md.-Va.									
Population	3,750,500	3,755,200	3,758,580	5,385,800	5,592,300	4,218,114	7,490,400	7,415,600	4,615,000
Total Employment	1,658,800	1,797,900	2,012,800	2,360,200	2,717,800	2,373,163	3,255,600	3,484,400	2,447,000
Richmond, Va.									
Population	1,196,400	1,162,500	1,174,740	1,597,600	1,423,100	1,441,366	2,087,800	1,610,100	1,634,680
Total Employment	487,200	515,600	606,380	643,000	653,100	791,999	834,400	724,400	851,610
Norfolk-Portsmouth, VA.									
Population	1,327,900	1,224,400	1,364,340	1,549,200	1,386,600	1,630,036	1,785,700	1,553,300	1,841,370
Total Employment	543,700	540,900	650,357	629,600	630,500	823,794	723,400	698,400	880,680
Total Bay Region									
Population	19,692,800	18,896,800	17,492,140	25,634,300	23,048,700	19,110,998	32,654,000	26,830,600	20,429,610
Employment	8,123,100	8,488,000	8,511,687	10,613,100	10,710,700	9,217,800	13,557,500	12,214,500	10,284,750

1/ All figures rounded off to nearest hundred.

2/ 1980 OBERS figures interpolated for comparison with 1980 and 2020 projections of other series.

3/ No-change-in-share series.

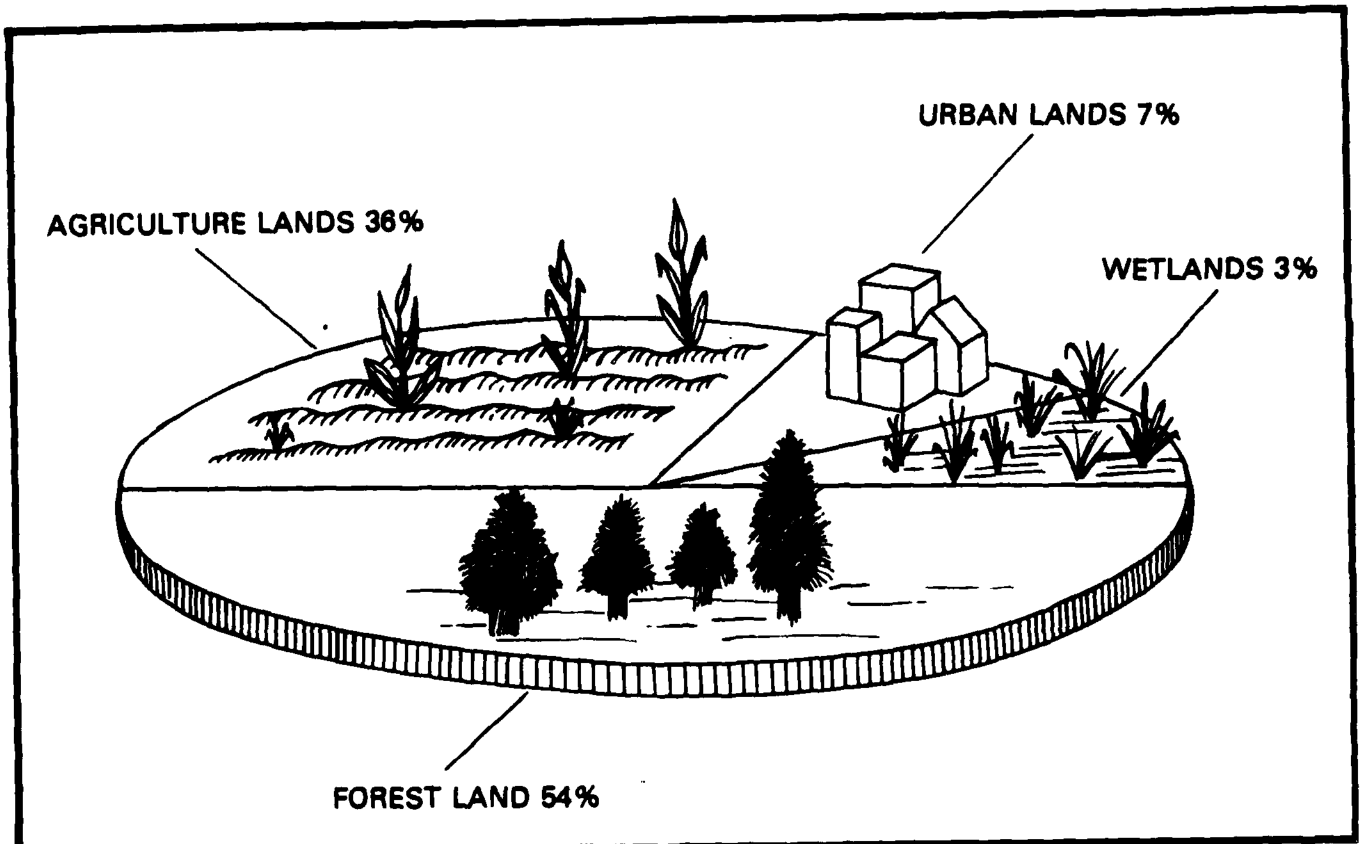


FIGURE A-8 MAJOR LAND USE TYPES - CHESAPEAKE BAY REGION

a. Urban Land: About 43 percent of the Bay Region is considered to be developed (i.e., urban plus agricultural lands). Of the 43 percent developed, 83 percent is in agricultural uses and only 17 percent is considered urban. Urban land uses are concentrated around the principal urban centers located near the head of tide on the major tributaries of the Western Shore. Many smaller urban centers are found scattered throughout the Study Area, some serving as small ports, retail and wholesale trade centers, or political centers such as state capitals or county seats. Industrial, institutional, and military reservations (of which the Bay Region has many) are also included as urban lands. Industrial activities include a variety of uses ranging from those involving the design, assembly, finishing, and packaging of light products to heavy manufacturing activities such as steel, pulp, or lumber milling, electric power generating, oil refining, and chemical processing. Most frequently, industries are found in or adjacent to urban areas where good transportation facilities and ample manpower are available.

b. Agricultural Land: Land used for the production of farm commodities comprises over one-third of the Chesapeake Bay Region's land area. As such, it constitutes the second largest land use type in the Study Area, second only to forest lands. The major physical factors governing the use of land for agricultural purposes include rainfall, growing season, soil, drainage, temperature, evaporation, and the amount of sunshine. Other factors such as proximity to markets, tax laws, land tenure arrangements, and farming practices also influence the intensity and type of agriculture. The major agricultural areas in the Bay Region are located on the Eastern Shore of Maryland, Virginia and Delaware, in the rural portions of the Baltimore SMSA, in the northwestern portion of the Washington SMSA, and around Virginia Beach, Virginia.

c. Forestlands: Forestlands occupy more area in the Bay Region than any other land use type, approximately 54 percent. Since it was not possible to distinguish between public and private forestlands on the rèmote sensing data, both are included in Figure A-8. The Virginia portion of the Study Area accounts for almost two-thirds of the total forest land. Southern Maryland also has a high proportion of woodlands.

d. Wetlands: The wetlands of the Bay Region, although accounting for only 3 percent of the total land area, are of crucial importance to the ecosystem of the Bay. Wetlands consist of occassionally flooded basins and flats, meadows, marshes, and bogs.

Each of the states in the Bay area has legally defined its wetlands. Maryland defines its wetlands as all land under the navigable waters of the State below the mean high tide which is affected by the regular rise and fall of the tide. Virginia wetlands are defined as all that land lying between mean low water and an elevation above mean low water equal to the factor 1.5 times the tide range. Delaware defines its wetlands as those lands above the mean low water elevation including any bank, marsh, swamp, meadow, flat or other land subject to tidal action and including those areas connected to tidal waters whose surface is at or below an elevation of two feet above local mean high tide.

Most of the counties of the Bay Region have some wetland areas of varying types and sizes, although it should be emphasized that not all wetland types are equally valuable to the ecosystem. The ecological value of a particular wetland area depends on such factors as the type of dominant plant, flushing action in the area which affects the availability of nutrients to the aquatic community, and the intensity of use of the wetland as habitat. The major concentration of wetland areas in the Chesapeake Bay system is found along the lower Eastern Shore.

e. Archaeological, Historic, and Natural Areas of Significance: The primary prehistoric archaeological resources within the Study Area are associated with Indian artifacts. The numerous Indian tribes which inhabited what is now Maryland, Virginia, and Delaware left much evidence of their existence in the form of clay pottery and stone artifacts. Thousands of archaeological sites have been recorded in the Region, but due to monetary and manpower limitations, it is believed that only a fraction of the archaeological resources have been discovered. Almost the entire shoreline of the Bay and its tributaries are thought to be potential archaeological sites.

The large number of historic sites in the Bay Region provides proof of the Region's historic significance and its fundamental role in the development of the Nation. Many of the sites relate to the earliest colonial settlements, the winning of National independence, the founding of the Union, the Civil War struggle, and the lives of National leaders. Within the Study Area are found such historically important items as the U.S. Frigate Constellation, the nation's oldest warship; the Annapolis Historic District, an early colonial port and Capital of the U. S. during a short period in 1783-1784; Stratford Hall, home of Robert E. Lee, Commander of the Confederate Armies; Mt. Vernon, home of the first President of the United States; numerous battlefield sites commemorating some of the most important Civil War and Revolutionary War battles; the Jamestown National Historic Site, first permanent English colony in North America; Williamsburg Historic District, capital of the Virginia Colony during much of the eighteenth century and an important social and cultural center of the English colonies during that period; and numerous historic and commemorative sites in the Washington, D.C. area.

There are certain other areas of the Bay Region which are of special importance for their ecological or natural significance. Many of these have been identified, and in many cases are being protected. Included in these types of areas are: important wetlands or other floral habitats, faunal habitats (especially for threatened or endangered species), and naturally scenic areas. At present, there are twenty properties within the Study Area designated as National refuges or related properties (such as the Patuxent National Wildlife Research Center). The primary purpose of these refuges is to protect wildlife including certain endangered and threatened species. Biological research is conducted at a number of these facilities while limited hunting is offered at some. Within the Study Area, there are approximately 70 state fish and wildlife management areas and related properties including game farms, sanctuaries, and preserves.

The Center for Natural Areas, Ecology Program, Smithsonian Institution, has also shown concern for the Bay's significant ecological and natural areas. In 1974, this group prepared a report entitled Natural Areas of the Chesapeake Bay Region: Ecological Priorities, which surveys the endangered flora and fauna of the Bay Region and the areas of significant ecological importance.

Maryland and Virginia have initiated programs to identify and designate certain rivers within their boundaries as scenic rivers. The Virginia Commission of Outdoor Recreation was directed by the General Assembly to study the Commonwealth's rivers for the purpose of designating those which should be protected to provide for the enjoyment of present and future generations. As a result of this survey, the Commission recommended in 1970 the establishment of a scenic river system. Local and State land use controls are to be imposed along with numerous other standards to guarantee the protection of those rivers designated as scenic. The Maryland Legislature also recognized that certain rivers within the State plus their adjacent land areas possess outstanding scenic, fish, wildlife, and other recreational values. The State adopted a policy which protects the water

quality of those rivers and fulfills vital conservation purposes by promoting the wise use of land resources within the scenic river system. Use is limited to "horseback riding, natural and geological interpretation, scenic appreciation, and other programs through which the general public can appreciate and enjoy the value of these areas as scenic and wild rivers in a setting of natural solitude." Appendix 4 of the Future Conditions Report lists the designated scenic and potential scenic rivers of the Chesapeake Bay Region.

FUTURE LAND USE

The expected future distribution of land uses in the Bay Region was developed from the relevant county, municipal, and regional comprehensive land and water use plans. Appendix 4 of the Future Conditions Report presents this information based on a consistent land use classification system. Numerical estimates of future acreages for urban, agricultural, and forest lands are presented in the following sections.

a. Urban: The portion of land in residential uses in the urban areas can be expected to increase at roughly the same rate as population growth if the assumption is made that population densities will remain at about the same level over the projection period. This means that the demand for residential lands will increase by approximately 18 percent by 1980, 59 percent by the year 2000, and about 107 percent by 2020.

As discussed earlier, manufacturing output in the Chesapeake Bay Region is projected to increase at a rate of approximately 560 percent between 1969 and 2020. It is not valid, however, to assume that land needed for industrial purposes will also increase by this percentage since output per worker and per unit of land will probably increase during this period. If the assumption is made that the productivity of land increases at about the same rate as the productivity of workers, about 3.0 percent annually, then the land needed for industrial purposes can be expected to increase by 28 percent over the 1969 acreage by 2000, and by 50 percent by 2020.

b. Agricultural: The projections of land in crops and miscellaneous farm uses (woodland on farms is included in the "Forests" category) in the Chesapeake Bay Region were derived from OBERS projections of these land use categories by state. The amount of acreage in cropland and miscellaneous farmland is projected to show a steady decline during the projection period as shown in Table A-10.

c. Forests: Projections of private commercial forest lands were also disaggregated from OBERS projections by state. As indicated in Table A-11, the projected acreage of private commercial forest land within the Study Area is expected to decline steadily over the projection period. It should be noted that public forest lands are not included in these figures.

d. Wetlands: Although no projections were prepared of future wetland acreages, it can be stated with a high degree of confidence that the demand for shoreline lands for

TABLE A-10
PROJECTED CROPLAND AND MISCELLANEOUS FARMLAND* FOR THE CHESAPEAKE BAY REGION
(THOUSANDS OF ACRES)

State	1980	2000	2020
Delaware	544	520	490
Maryland	1,614	1,490	1,360
Virginia	1,481	1,300	1,150
Total Chesapeake Bay Region	3,639	3,310	3,000

* Miscellaneous farmland includes pasture, range, lands occupied by buildings, roads, ditches, ponds, and wastelands.

TABLE A-11
PROJECTED ACRES OF PRIVATE COMMERCIAL FOREST LAND FOR THE CHESAPEAKE BAY STUDY AREA

	1980	2000	2020
Delaware	365,560	355,900	346,300
Maryland	1,983,456	1,935,300	1,860,700
Virginia	4,533,673	4,222,700	3,901,000
Total:	6,882,689	6,513,900	6,108,000

such uses as marinas, vacation homes, or port facilities will increase in the future. However, more stringent Federal and state restrictions on the development or degradation of wetland areas along with a growing awareness of the ecological and economic importance of wetlands are likely to at least slow down the historic rate of wetlands destruction in the Chesapeake Bay Region. An Executive Order signed by President Carter in 1977 sets more stringent guidelines governing Federal activities in wetland areas.

As shown in the previous section, the expected increases in the demand for residential and industrial land in the Chesapeake Bay Region is approximately offset by decreases in agricultural and forest use (each projected separately). The locations in which these land use changes will occur, however, have not been clearly defined. The conflict, then, is not one of enough land for development, but where the development should take place. Often the best agricultural lands or the most productive forests are also desirable for urban development. Without proper planning, areas of special ecological, historical, or archaeological significance will continue to be destroyed in the wake of "urban sprawl."

INSTITUTIONAL FRAMEWORK

INTRODUCTION

For the purposes of this study, an institution is an organization which uses certain administrative, political, and social processes to implement and/or manage water use and control in an area. An institution may be a formal (i.e., formed by law or contract) or an informal (i.e., formed by consensus of people, usually with no strict legal basis) body, group, or agency. For water supply management, the institution is usually formal. State governmental agencies, bi-state agencies and interstate commissions are examples.

The processes utilized by these institutions may be formal (i.e., in the charter or by-laws) or informal (i.e., not written down but assumed) practices, procedures, customs or traditions. The establishing of rates or a general attitude by the institution toward financial obligations are examples.

Government planning in the Chesapeake Bay Basin is conducted by three levels of government (Federal, state, and local) with three branches within each level (legislative, executive and judicial). This three by three matrix of planning cells has varied in its effectiveness in both planning and managing the water resources of the basin. The effectiveness of the planning has generally been a function of the complexity and geographical extent of the problem. Where problems have extended beyond the boundaries of traditional units of state and local government, there have been some past problems with effecting a solution.

The purpose of the institutional analysis conducted as part of this study was to identify in general terms the existing institutional framework responsible for water use and/or management in the Chesapeake Bay Basin. The primary focus was the identification of those agencies and institutional agreements related to the control of the quantity of water entering the Bay from its principal tributaries. This primary focus was adopted in order to be responsive to the needs of the Low Freshwater Inflow Study.

Included in this section of the report is a brief discussion of raparian water use principals applicable in the Bay Region and a detailed discussion of the water resource related responsibilities of the many Federal, state and local agencies in the Region which are listed on Table A-12.

RIPARIAN DOCTRINE

Various sources enunciate the legal doctrines and principles that govern and regulate water and its uses. Those of primary importance are the Federal and state constitutions, common law decisions, and statutory enactments. None of these sources alone determine the legal right pertaining to water law. Each supplements the other and serves as a basis for management of water use and flow control.

A review of water law in force in the United States reveals that there is a great difference beween the Western States and the Eastern States in basic doctrine. The dividing line between east and west coincides quite generally with a line through the Prairie States, that separates those states with 20 inches or less or rainfall from those states with more than 20 inches.

The group of states west of a line running from North Dakota to Texas, a water "shortage" region, operates its water laws under one form or another of what is called an "appropriation" doctrine. This doctrine emphasizes exclusive right of use of specific quantities of water at a prescribed time and place subject to the rule of beneficial use. Right of use in this case is not dependent upon ownership of land contiguous to the water supply, or even upon ownership of any land in some cases.

The Eastern States, which include the Chesapeake Bay Basin states, are generally referred to as a water "excess" region and are governed by the riparian doctrine. This system emphasizes the rights of water users in common without regard to specific quantities, times, or places of use. Rights under the riparian doctrine are dependent upon ownership of land contiguous to the water supply. All such owners have equal right to co-share in the use of the waters, so long as each riparian is reasonable in his use. Riparian rights are further considered usufructuary in nature. That is, they are rights of use, not ownership, of the flowing waters. Riparianism is the only doctrine used by the Chesapeake Bay Basin states.

EXISTING FEDERAL WATER RESOURCES INSTITUTIONS

The concept of Federal responsibility for comprehensive development of the water and related land resources is embodied in legislative enactments under the Commerce and Welfare Clauses of the Constitution, as well as with the gradual growth of a body of policy by repeated authorization of specific types of projects. The fundamental objective of the Congress in authorizing Federal participation in resource development has been to insure that the Nation's resources make an optimum contribution to the health and welfare of its people. At the same time, the Congress seeks to maintain a reasonable balance between the powers assumed by the Federal Government and those to be left with the states, local governmental entities, and private enterprise.

The Water Resources Planning Act of 1965 officially identified the following as National policy and emphasized local state-Federal cooperation:

> In order to meet the rapidly expanding demands for water throughout the Nation, it is declared to be the policy of the Congress to encourage the conservation, development, and utilization of water and related land resources of the United States on a comprehensive and coordinated basis by the Federal Government, states, localities and private enterprise, with the cooperation of all affected Federal agencies, states, local governments, individuals, corporations, business enterprises, and others concerned (U.S. Code, Title 42, Sec. 1962).

Continued efforts are still being undertaken through legislation for the cooperative approach to water resources planning. Table A-12 presents those institutions that are involved in that effort on a National scale. There are basically three ways in which the Federal Government contributes to projects of regional or local benefit: directly, indirectly, and financially. Direct participation involves research, planning, preparation, operation and maintenance (or any combination of these) of one or more elements of a project by the Federal Government itself. Indirect aid includes services of information, advice and assistance for activities of other levels of government in research, planning, engineering, and technical areas, as well as use of Federal facilities. Financial aid is usually in the form of direct grants, perhaps tied to specific purposes; loans, (repayable or nonrepayable), advances, and purchase or underwriting of bond issues.

TABLE A-12
INSTITUTIONS WITH WATER RESOURCES RESPONSIBILITIES
CHESAPEAKE BAY DRAINAGE BASIN

FEDERAL AGENCIES

Department of Agriculture
Agricultural Research Service
Soil Conservation Service

Department of Defense
Corps of Engineers

Deprtment of the Interior
Geological Survey
Fish and Wildlife Service

Department of Commerce
Economic Development Administration
National Marine Fisheries Service
National Oceanographic and Atmospheric Administration

Department of Housing and Urban Development

Environmental Protection Agency

STATE AGENCIES

Delaware
Department of Natural Resources and Environmental Control
Bureau of Environmental Health

Distict of Columbia
Department of Environmental Services

Maryland
Department of Natural Resources
Water ResourcesAdministration
Tidewater Administration
Wildlife Administration
Wetland Administration
Department of Health and Mental Hygiene
Office of Environmental Programs

New York
Department of Environmental Conservation
Department of Health

Pennsylvania
Department of Environmental Resources
Office of Environmental Protection
Office of Resources Management

Virginia
Secretary of Commerce and Resources
State Water Control Board
Marine Resources Commission
Commission of Game and Inland Fisheries
Council on the Environment
Division of Parks
Soil and Water Conservation Commission
Secretary of Human Resources
Department of Health
State Corporation Commission

West Virginia
Department of Natural Resources

INTERSTATE/REGIONAL AGENCIES

Susquehanna River Basin Commission

Metropolitan Washington Council of Governments

Potomac River Fisheries Commission

Chesapeake Bay Commission (Maryland and Virginia)

Interstate Commission on the Potomac River Basin

Atlantic States Marine Fisheries Commission

Maryland-Virginia Bi-State Working Committee on Chesapeake Bay

Grants may be for specific projects, or they may be formula grants, in which the size of the grant depends by formula on certain criteria: population, income and geographical area. In general, there is a matching requirement to be met by the recipient. Direct loans may be made at zero or less-than-market interest rates, or if at market rates, in an amount greater than would ordinarily be available. Non-interest bearing advances are usually repayable, but may be made nonrepayable if certain conditions are met. A bond issue of a state, local, or non-governmental agency may be guaranteed or purchased outright, a loan made to such an agency might be guaranteed or purchased outright, or a loan made to such an agency might be guaranteed or insured. Detailed information concerning the specific programs of these agencies may be found in the Office of Management and Budget's Catalog of Federal Domestic Assistance, Government Printing Office, Washington, D.C. (1978).

Within the Department of Agriculture, the Agricultural Research Service conducts research to provide a scientific basis and support for the land and water resource programs. The Soil Conservation Service provides assistance to localities for small watershed planning leading to works of improvements and grants for the acquisition of land, access rights, or facilities for recreation, conservation or flood protection in small watersheds.

Under the Department of Commerce, the Economic Development Administration makes grants or loans for the development of land and improvements for public works. The mission of the National Oceanic and Atmospheric Administration (NOAA) is to explore, map, and chart the global ocean and its living resources, to manage, run, and conserve those resources and to describe, monitor, and prodict conditions in the atmosphere, ocean, sun and space environment, issue warnings against impending destructive natural events, develop beneficial methods of environmental modification, and access the consequences of inadvertent environmental modification over several scales of time. Organizations within NOAA that are involved in Bay activities include the National Ocean Survey and the National Marine Fisheries Service.

The Army Corps of Engineers issues permits for all proposed dredging and filling operations in the navigable waters of the United States, including wetlands landward at least to the extent of mean high water. Corps of Engineers Water Resources Development Programs include structural and nonstructural elements, such as: (1) improvement of harbors and navigable channels (33 USCA 540); (2) engineering reports on streams, shores, and flood plains (33 USCA 426); and (3) flood control and related works for water supply (33 USCA 708).

The Department of Housing and Urban Development provides funding for states and general purpose local governments for acquisition and disposition of real property, and the construction of certain public facilities, such as water and sewer lines.

The Environmental Protection Agency provides grants to area-wide planning agencies for preparation of plans in areas which, as a result of urban industrial concentration, have water quality control problems.

Within the Department of the Interior, the U.S. Geological Survey performs evaluations of all available waters in river basins and groundwater provinces. The U.S. Fisn and Wildlife Service is responsible for wild birds, endangered species, certain marine mammals, inland sport fisheries, and specific fishery and wildlife research activities. Resource management activities of the Service include biological monitoring,

environmental impact assessments through river basin studies and area planning and preservation.

Other Federal agencies involved in water resource programs include the Federal Energy Regulatory Commission through its licensing of dams and the U.S. Coast Guard through its oil and hazardous material coastal spill responsibility.

EXISTING INTERSTATE AND BASIN INSTITUTIONS

Within the Chesapeake Bay Region there are several institutions which have water resource related responsibilities and functions on an interstate level. Included are the Interstate Commission on the Potomac River Basin (ICPRB), the Metropolitan Washington Council of Governments (MWCOG), the Susquehanna River Basin Commission (SRBC) and the others discussed below.

INTERSTATE COMMISSION ON THE POTOMAC RIVER BASIN (ICPRB)

In 1940, the Congress authorized Maryland, Virginia, Pennsylvania, West Virginia and the District of Columbia to enter into a compact providing for the creation of a conservancy district in the Potomac River Basin for "... the purpose of regulating, controlling, preventing, or otherwise rendering unobjectionable and harmless the pollution of the waters of Potomac drainage area by sewage and industrial and other wastes." (Public Resolution No. 93, 76th Congress, 54 Stat 748; 1940.) Recent Congressional action in 1970 completed what was at least a six-year effort to revise the ICPRB compact. These amendments broadened the authority of ICPRB: (1) to include water resources and associated land resources; (2) to allow ICPRB to cooperate with and assist public and non-public agencies in planning related to water resources and associated land resources; and (3) to provide for the establishment of sections consisting of the Commissioners interested in problems which affect two or more, but not all, of the signatories (Article III of the Compact). Basically, these powers are advisory.

The ICPRB consists of three members from each of the four states and the District of Columbia, and three members appointed by the President. Each member provides for selection of its representatives; for example, Virginia law requires appointment by the Governor with one member required to be a resident of the basin, one a member of the Virginia Commission on Interstate Cooperation, and the other to be appointed at large.

The Commission is financed by appropriations from the signatories and the United States. These appropriations vary depending upon the financial status of each of the signatories, as well as the number of projects under study by the Commission that benefit the signatory. The compact allows a signatory to withdraw after one year's notice.

CHESAPEAKE BAY COMMISSION

The Chesapeake Bay Commission was created by the 1980 General Assemblies of the State of Maryland and the Commonwealth of Virginia (Maryland Annotated Code, Article NR Sec. 8-302; Code of Virginia, Sections 62.1-69.5 to 62.1-69.20).

The creation of the Commission was the culmination of an effort begun two years earlier, when the Chesapeake Bay Legislative Advisory Commission was created by the Maryland and Virginia General Assemblies to examine ways in which intergovernmental coordination in management of the Chesapeake Bay could be enhanced.

The primary purposes of the Commission are to assist the legislatures of the two states in responding to problems of mutual concern, and encourage cooperative coordinated planning and action by the signatories and their executive agencies.

The duties of the Chesapeake Bay Commission are to:

- identify specific Bay management concerns requiring intergovernmental coordination and cooperation;

- recommend to the states and/or to the Federal and local governments legislative and administrative actions necessary to effectuate coordinated and cooperative management of the Bay;

- collect, analyze, and disseminate information pertaining to the region and its resources for the respective legislative bodies;

- represent the common interests of the signatories as they are affected by the activities of the Federal government, and assist in monitoring those activities;

- provide an arbitration forum to serve as an advisory mediator for bi-state conflicts.

METROPOLITAN WASHINGTON COUNCIL OF GOVERNMENT (MWCOG)

The MWCOG became incorporated as a non-profit organization in 1965. Sixteen major local governments - the District of Columbia, two major Maryland and four Virginia counties, and nine cities - are represented on the MWCOG. The general membership includes all elected officials of the counties and cities (220); the District of Columbia Mayor, Deputy Mayor, and the City Councilmen; Maryland and Virginia state legislators and Congressmen who represent districts in their states that fall within MWCOG's jurisdiction; and all the members of the District committees of both houses of Congress, until such time as the District of Columbia is given Congressional representation.

The Council is empowered to advise and assist local governments of the region to: (1) identify mutual problems; (2) develop and promote a comprehensive regional plan; (3) seek mutually desirable policies and develop cooperative mechanisms among local governments; (4) support and promote concerted action among the local governments; and (5) serve at the request of local governments as their representative on regional matters. The Council does not have authority to legislate, regulate, enforce or tax; and member governments can oppose any proposal or withdraw from MWCOG whenever they choose. The fact that a representative from a given community votes in favor of a proposed council action in no way obligates his or her community to follow his or her lead. MWCOG is limited by its charter to advising and assisting local governments of the region on areawide matters. Although the charter does give it authority to represent local governments on matters of regional concern upon their request, this authority has not been interpreted broadly enough to permit MWCOG to engage in the direct operation of regional facilities. As a result, MWCOG is not in a position to take advantage of certain economies of scale through regionalization, although it can and does encourage such economies through its comprehensive planning and advisory roles.

SUSQUEHANNA RIVER BASIN COMMISSION (SRBC)

In the early 1960's, citizen concern regarding water resources problems in the Susquehanna River Basin flooding, drought, and water pollution stimulated the formation of the Susquehanna River Basin Association, a citizens' organization. The Association and other groups, including all levels of government, expressed the need for comprehensive river basin studies to develop solutions to resource problems in the basin. As the Susquehanna River system is interstate, it was considered desirable to have some type of regional governmental institution to deal with water resources problems, and to implement management measures on a basinwide basis.

The Congress of the United States recognized a National interest in the Susquehanna River Basin, and in 1962 authorized and funded a comprehensive study of the water resources of the basin. The Baltimore District of the Corps of Engineers was assigned to manage this study which was completed in 1970. Concurrently, citizen and state activities led to the creation of an Interstate Advisory Committee for the Susquehanna River Basin, with membership derived from the States of New York, Pennsylvania, and Maryland.

This Committee began functioning in 1963, and after much study and deliberation concluded that a regional approach to development issues of the basin was advisable, feasible and urgently needed. The Committee thus drafted a Federal - interstate compact for the comprehensive planning management, development, use and conservation of the water resources of the basin, and recommended that the compact be adopted by the member states and the Federal government.

The President of the United States signed the Susquehanna River Basin Compact into law December 24, 1970, subsequent to its approval by Congress and the prior approval of the involved states. The Compact provided for the creation of a single administrative agency to coordinate water resources efforts and programs of Federal, state, local and private interests in the basin. Within a few months of the signing of the Compact the signatory parties established the Susquehanna River Basin Commission as the administrative agency.

The members of the Commission are the Governors of the signatory states or their designees and an appointee of the President of the United States. Each member may appoint an alternate to serve and act on his behalf and at his pleasure. A full-time staff serves the Commission.

To meet its mandated duties and accomplish the purposes and goals set forth in the Compact, the Commission coordinates basinwide water resources planning by formulating, adopting and implementing a comprehensive plan for the basin. Inherent in this process is the coordination of the planning efforts of others affecting water resources, stimulation of public awareness, and the implementation of related action programs. The Commission serves as a water resources project development, management and operation agent, as it determines necessary. As the need is demonstrated, it will develop a capability for coordination and management of the funding and conduct of public works programs and projects in the basin.

In its role as coordinator of basinwide water resources planning, the Commission seeks to integrate planning done at the Federal, state and local levels of government with that done by the private sector. It seeks to provide opportunity for all interest groups to

express their views and to reconcile differences between groups when possible. Further evidence of the Commission's leadership roll in basin development is exerted through its project review function. This function is oriented towards the evaluation of projects and proposals for development, use, and management of the water resources of the basin in terms of its planning and program objectives as well as the goals set forth in the plan, and on the basis of a comprehensive public viewpoint in terms of project effects. This public viewpoint is sought through public hearings, informal contacts, and through views formally expressed to the Commission.

Some examples of projects and programs considered under project review are: allocations, withdrawals and diversions of water; development of nonstructural and structural measures for flood damage reduction, water supply storage, low flow augmentation, water related recreation; water quality standards and their application; and protection and preservation of natural amenities.

It should be noted that the role of the Commission for any given endeavor will vary according to the extent others act to meet the overall goal of optimum development of the basin's water resources. Where the Commission determines that the existing programs of others do not meet identified demands, it acts to encourage the appropriate signatory or signatories to accelerate programs, reorder priorities or establish new programs. The Commission may also act directly to meet demands through the exercise of powers granted it by the Compact.

Extensive duties are required of the Commission and can be briefly outlined as follows:

1. Develop and effectuate plans, policies, and projects relating to water resources; adopt, promote, and coordinate policies and standards for water resources conservation, control, utilization, and management; and promote and implement the planning development, and financing of water resources projects.

2. Undertake investigations, studies, and surveys, and acquire, construct, operate, and maintain projects and facilities in regard to the water resources of the basin whenever it is deemed necessary to do so to activate or effectuate any of the provisions of the Compact.

3. Administer, manage, and control water resources in all matters determined by the Commission to be interstate in nature or to have a significant effect on the water resources and water resources management.

4. Assume jurisdiction in any matter affecting water resources whenever it determines, after investigation and public hearing upon due notice given, that the effectuation of the comprehensive plan or the implementation of the Compact so requires. If the Commission finds upon a subsequent hearing requested by an affected signatory party that the party will take the necessary action, the Commission may relinquish jurisdiction.

5. Investigate and determine if the requirements of the Compact or the rules and regulations of the Commission are complied with, and if satisfactory progress has not been made, institute an action or actions in its own name in any state or Federal court of competent jurisdiction to compel compliance with any and all of the provisions of the Compact or any of the rules and regulations of the Commission adopted pursuant thereto.

The necessary authority to act on these duties is delegated to the Commission by the Compact signatories, as are such other and different powers which are necessary or convenient to carry out its express purposes, or purposes which may be reasonably implied therefrom.

It is clearly presented in the Compact that the very extensive authority granted the Commission is conditioned to preserve and utilize the functions, powers and duties of existing offices and agencies of the signatory parties to the extent consistent with the Compact.

The SRBC Comprehensive Plan, which was adopted in December 1973 and periodically amended several times since, forms the basis for multi-purpose water resource planning. The plan addresses six major areas of water resource concern and sets important goals and objectives in each of these areas. The policy, review and program activities of the Commission flow from the requirements set forth in the Comprehensive Plan.

ATLANTIC STATES MARINE FISHERIES COMMISSION (ASMFC)

The states of the atlantic seaboard have entered into a compact for the better utilization of fisheries. The compact, which was induced by an act of the 76th Congress of the United States, entitles each member state to be represented by three commissioners on the Atlantic States Marine Fisheries Commission. ASMFC is composed of four regionally functional units, one of which is the Chesapeake Bay Section comprised of the States of Maryland and Virginia.

The Commission is responsible for the promotion of better use of fisheries by developing a joint Federal-state program for promotion and protection of fisheries and by preventing their physical waste. Activities include coordination of states' regulatory powers, drafting and recommending state and Federal fishery legislation, promoting research on marine environments and fisheries resources, consulting with and advising state administrative agencies on fishery problems and educating public and government officials on the importance of environmental and fishery resources and on the need for preservation. The Commission may also have regulatory authority over fisheries of common interest to two or more states if this authority is granted by the states involved.

POTOMAC RIVER FISHERIES COMMISSION (PRFC)

The PRFC is a Maryland and Virginia bi-state Commission created by the Maryland-Virginia Compact of 1958. This Commission is a semi-autonomous agency, but its work and policies are tied in very closely with the Department of Natural Resources of Maryland and the Virginia Marine Resources Commission. The Commission is responsible for the establishment and maintenance of a program of conservation and improvement of the seafood resources of the Potomac River. The largest part of the Commission's budget is always devoted to oysters. The regulation and licensing of fisheries in the Potomac River are also functions of this Commission.

CHESAPEAKE BAY RESEARCH COORDINATION ACT OF 1980

The Act calls for establishing a Chesapeake Bay Research Board--composed of various Federal, state, local, and private sector representatives--to coordinate Bay area research and to perform certain specific functions, such as developing a research plan and

evaluating Federal research programs. The Act requires the Secretary of Commerce to select seven members and the Governors of Maryland and Virginia to select four members each. The Act requires also that an Office for Chesapeake Bay Research Coordination be established within the Department of Commerce to serve as the staff of the Research Board.

The basic intent of the Act is to coordinate research of the Chesapeake Bay area effectively. Clearly, however, the Act has other purposes as well. The Act requires the Research Board to: (1) develop a research plan and update the plan biennially to reflect changing priorities and the need for fundamental research; (2) periodically review Federal research programs pertaining to the Bay and determine the extent to which the research programs are consistent with the research plan; and (3) submit an annual report to the Congress and the Governors of Maryland and Virginia on current and planned research programs pertaining to the Bay and their relationship to the research plan, together with recommendations for improving research coordination.

In addition, the Act requires the Office for Research Coordination to carry out a number of specific activities, such as establishing a Chesapeake Bay research exchange to enhance the dissemination and use of information pertaining to ongoing, completed, and future research projects.

In December 1981, Maryland and Virginia's Bi-State Working Committee on the Chesapeake Bay requested that the Department of Commerce (NOAA) establish an ad hoc group of Federal agency representatives involved in Bay area research to assist in developing a research plan. NOAA accepted the proposal and formed an ad hoc committee, composed of representatives from the Departments of Army and Interior, Smithsonian Institution, National Science Foundation, EPA, and NOAA. A NOAA official has been designated the Committee's Executive Secretary. It is NOAA's intent to have the ad hoc committee interact with officially appointed representatives from Maryland and Virginia and thus form a mechanism to address a variety of Federal-state research issues involving the Bay. The act has a termination date of September 30, 1984.

EXISTING STATE AND LOCAL WATER RESOURCES INSTITUTIONS

The Chesapeake Bay and its shores are owned by the states and their local subdivisions. Included in the following paragraphs are a description of the primary responsibilities of those state agencies concerned with water resources management in the Chesapeake Bay Region. In general more detailed descriptions are provided for Maryland and Virginia agencies as these two states have a much greater influence on the Bay.

STATE OF DELAWARE

For the most part, the State of Delaware does not play a major role in the protection or the enhancement of water resources within the Bay. The jurisdiction of the State over waters entering the Bay is confined to the headwaters of tributaries on the Eastern Shore and to the Chesapeake and Delaware Canal.

The official Delaware water resources management agency is the Department of Natural Resources and Environmental Contro.. The Water Resources Section of the Environmental Control Division, Department of Natural Resources and Environmental Control, focuses on three mission areas: water supply (allocation for consumption), planning (with respect to PL92-500), and water pollution control (NPDES permit program,

review of construction grant permits, and a compliance monitoring program). A technical services group provides sampling and analytical services in support of the Division's responsibilities. In support of the Delaware Environmental Protection Act, the Water Resources Section collects samples on a regular basis from the Chesapeake and Delaware Canal.

In the enforcement of Title 17 of the Delaware Health and Safety Code, the Bureau of Environmental Health is responsible for the quality of drinking water, waters utilized for swimming, institutional and camp health, and general sanitation within the State. The Bureau conducts monitoring of streams (ones used as sources of potable water) and shellfish waters.

DISTRICT OF COLUMBIA

The executive power of the District is vested in the Mayor who is the chief executive officer of the District Government. The Mayor's office is the central planning agency for the District. He is responsible for the coordination of planning activities of the municipal government and the preparation and implementation of the District's elements of the comprehensive plan for the National Capital which may include land use elements; urban renewal and re-development elements; a multi-year program of municipal public works for the District, and physical, social, economic, transportation and population elements. The Mayor's planning responsibility does not extend to Federal and international projects and developments in the District, as determined by the National Capital Planning Commission, or to the United States Capitol buildings and grounds. With respect to water supply for the District, the legal position is encapsulated within the power of the U.S. Government. Congress has dealt with the water needs of the District by the establishment of the Washington Aqueduct and delegation to the Chief of Engineers of the planning and operational responsibilities relative to providing the District and certain nearby suburban communities with their supply of potable water. (Act of March 3, 1859; 11 Stat. 435).

The District of Columbia's water management agency is the Department of Environmental Services. Under the Mayor and the Council, a Department of Environmental Services exists to provide a safe, healthful, and aesthetically attractive environment in the District. The functions are:

(1) plan, provide, operate and maintain sanitary services, systems and facilities which will maintain, improve, and promote the well-being of the community and its people, including distribution of water, control and disposal of storm water collection, treatment, and disposal of sewage; administration of revenue and special fund activities relating to water, sewer, and other services, cleaning of streets and alleys, and collections, processing and disposal of refuse;

(2) prepare and recommend to the Commissioner, environmental criteria and standards, as well as rules, regulations and plans for their enforcement, for the following: air quality, water quality, radiation, noise, solid waste storage, collection and disposal and other areas of environmental quality problems in the District of Columbia;

(3) conduct planning research and monitoring activities designed to detect, and provide an early warning of potential environmental quality problems in the District of Columbia.

STATE OF MARYLAND

The right to use water in Maryland has developed through court decisions as a part of the Common Law of the State. Maryland's adoption of an appropriation permit program is a system by which Maryland's sovereign prerogatives over water withdrawals within its territorial boundaries are recognized and assessed. Under this system, Maryland's authority over withdrawals under a "riparian" permit system is not to allow it to deprive any lower riparian of a reasonable use of river waters. Maryland, therefore, is to insure that an adequate supply of water is available to the competing interests within the framework of Maryland's sovereign authority to regulate the appropriation of water within its boundaries.

Although most of the water management decisions and controls are handled by the major State agencies (described below), water supply services are also provided by local governmental units, State-created sanitary districts, county sanitary districts and planning commissions, and private companies. Counties, cities and towns in Maryland derive their water supply management activities from several areas of the Maryland Code. Sections 78 to 91 of Article 23B of the Maryland Code outline the powers a city or town has in regard to water supply. A city or town may construct, operate and maintain a water system and water plant. Article 25 includes provisions allowing counties to establish public drainage associations and public watershed associations and to provide for erosion control. The powers and responsibilities of counties in regard to providing water supply are not specifically set forth anywhere in the Maryland Code. Under sections of Article 43, the counties may indirectly provide these services through creation of water authorities and sanitary districts. However, water authorities, may not compete with existing public or private utilities.

County governing bodies include the County Commissioners, sanitary and planning commissions, and health departments. The sanitary commissions are responsible for the construction and maintenance of works of improvement for water and sewerage facilities. The commissions are directly accountable to the County Commissioners, who provide or approve funds for the projects. The responsibility of the planning commissions is to prepare and adopt a plan for the general purpose of guiding and accomplishing the coordinated, adjusted and orderly development of each county. These plans must include an inventory of existing and expected water supply and sewage disposal needs. The county plans are intended to provide a detailed comprehensive listing of water supply, and wastewater management and project needs pictured at the county level. Environmental health services are the responsibility of the county health departments, each of which has a resident Deputy State Health Officer. The health departments issue permits for sewage treatment plant operations.

Municipal governing bodies usually have their authority vested in the mayor. According to the statutes, municipal authorities may take or acquire other property in fee or as an easement, within or outside the municipality for the construction, establishment, extension, alteration or maintenance of any facility for a water supply, sewage, drainage, or refuse disposal project. The larger incorporated towns have planning, water and sewage departments.

The various agencies that have water resources management responsibilities are discussed below.

Department of Natural Resources (DNR)

The Department of Natural Resources was created in 1969, and gives Maryland the opportunity to effectively plan the conservation and development of its water and land related resources. The Department was established to review, unify, coordinate and promulgate all natural resources policies, plans, programs and practices of State, county, regional and Federal agencies and institutions. It insures the management of all Natural resources for the greatest benefit of the State and its citizens. The many agencies organized under the Department are charged with the responsibility of protecting the natural resources and enforcing the regulations designed to conserve and protect the environment. The central agency within DNR which deals with water resources management is the Water Resources Administration (WRA). The powers and duties of the Administration include:

(1) preparing and developing a general water resources program which contemplates the proper development and management of the waters of the state on a multiple-purpose basis;

(2) making surveys, maps, investigations and studies of the water resources of the State;

(3) controlling, through the issuance of permits, the appropriation and use of the surface and underground water of the State (except for agricultural use);

(4) construction, reconstruction and repair of dams, reservoirs or waterway obstructions;

(5) permits for conduits, pipes, etc. pertaining to the Potomac River;

(6) regulate well drilling through the licensing of well drillers, and issuance of permits to drill wells.

(7) pollution control - comprehensive powers on all aspects including enforcement.

Other agencies within DNR that are involved with water resources management include the Tidewater Administration, the Wildlife Administration, and the Wetlands Administration.

The Tidewater Administration is responsible for several programs which are applicable to the tidal waters and adjacent areas, including coastal resources management (including the Federal Coastal Zone Management Program), enhancement of tidal fisheries, and improvement of navigable waterways through specific projects.

The Wildlife Administration regulates hunting and manages wildlife populations and habitats.

The Wetlands Administration regulates and develops permits for the dredging and filling of state-owned wetlands.

The DNR is primarily a regulatory and resource management agency. It also includes the Maryland Environmental Service, however, which constructs and operates wastewater treatment plants and potable water treatment and supply facilities.

Department of Health and Mental Hygiene

The Department exercises responsibility for the general supervision and control over the sanitary condition of the waters of the State as related to public health. This responsibility is carried out by the Department's Office of Environmental Programs. It's powers and duties include the following:

(1) supervise and control the waters of the state, insofar as their sanitary and physical conditions affect the publci health or comfort;

(2) investigate all sources of potable water and all points of sewage discharge;

(3) examine all existing public water supplies, sewerage systems, and refuse disposal plants with power to compel their operation to protect the public health and comfort, and order their alteration, extension or replacement by other structures when deemed necessary;

(4) review the design and construction of all public water supplies, sewerage systems, and refuse disposal plants;

(5) govern the individual water supply and sewage disposal systems for homes and other establishments in the counties of Maryland where public water supply and sewerage systems are not available;

(6) promote the construction of water, sewerage, and solid waste facilities with the use of Federal and State funds;

(7) consult with and advise county and municipal authorities and others on water supply and waste disposal problems;

(8) encourage basin-wide plans leading to the intergration of communities to be served by single treatment facilities where possible.

STATE OF NEW YORK

The New York State jurisdiction over waters in the Chesapeake drainage area is confined to upper part of the Susquehanna River Basin (23 percent of total Susquehanna drainage). The underlying principle of New York's water policies, as indicated by the State's constitution and its statutes, is that water is a natural resource, not to be conquered by man, but to be sought, recovered, processed, utilized, reclaimed, and reutilized.

The new era in water resources management in New York State began in 1960 when the Conservation Law was revised, and a new Article 5, called the Water Resources Law was passed by the Legislature. The Declaration of Policy in Article 5 of the Water Resources Law sets the course to be followed by the State. Among the major declarations of public policy concerning water supply are that:

(a) the acquisition, storage, diversion, and use of water for domestic and municipal purposes shall have priority over all other purposes; and

(b) in addition to other recognized public beneficial uses and control of water as provided by this Article 5, or by any other statute, the regulated acquisition, storage, diversion, and use of water for the supplemental irrigation of agricultural lands within this state is a public purpose and use, in the interests of the health and welfare of the people of the State and for their interest (Conservation Law, Section 401).

The structure of local government in New York is remarkable for the multiplicity of types of political subdivisions employed. The state is divided into 62 counties and the counties are in turn divided into varying numbers of cities and towns. Town boundaries are contiguous so that every portion of the state outside of the corporate limits of a city is included in a town. Two types of municipal corporations exist in New York State-the village and the city.

Although various agencies have been charged with the preparation and administration of water management programs ranging from hydroelectric power generation to municipal water supply and navigation, the majority of water management activities have been grouped within the Department of Environmental Conservation.

Its major responsibilities and duties include:

(1) planning, developing, and managing the State's water resources;

(2) undertaking studies on a regional basis, preferably with local participation, for the protection, conservation, development, and use of water resources within any region of the State;

(3) apportioning water for public water supply systems;

(4) investigating the purity of public water supply systems and the works constructed;

(5) controlling well drilling on Long Island;

(6) licensing certain public corporations for the diversion of certain water used in the generation of power;

(7) classifying the waters of the State and establishing standards of quality and purity;

(8) draining agricultural lands, primarily through districts set up for this purpose;

(9) regulating rivers and river improvements through districts set up for these purposes;

(10) implementing flood control and flood plain management and planning public water supply systems for intermunicipal areas; and,

(11) protecting stream beds from disturbance, controlling dredging and fill in navigable waters, and controlling the construction of dams and docks.

The principal agencies outside the Department of Environmental Conservation that have water management responsibilities are the Department of Health, for municipal water supplies; the Department of Transportation, for management of the State Barge Canal; the Office of Parks and Recreation, for recreational uses of water; and the Power Authority of the State of New York, for hydroelectric power generation.

COMMONWEALTH OF PENNSYLVANIA

A portion of the Potomac River Basin and a majority of the Susquehanna River Basin waters (76 percent) are under the jurisdiction of the Commonwealth of Pennsylvania. Under Pennsylvania's current constitution (effective 1 January 1968) there are no stipulations in connection with the administration and management of natural resources. Instead, the constitution invests supreme executive power in the Governor for the execution of all laws. The General Assembly has the power to prescribe other executive officers through legislative procedures, and approves the Governor's appointments of agency heads in the executive department of State government.

Pennsylvania's formal organization for administering its water resources development and regulation has been, until recently, a decentralized pattern of several State agencies. These agencies were assigned different administrative and technical aspects as water resources problems developed. However, a revision to the Administration Code, which became effective on January 19, 1971, was a major step toward centralizing water management functions. This legislation combined the powers, organization, and responsibilities of those agencies and bureaus concerned with natural resources into the Department of Environmental Resources (DER).

The agencies within DER that are responsible for water resources management are the Office of Environmental Protection and the Office of Resources Management. The extent of their water resources authority, and powers include:

(1) water supply: power to grant water rights to municipalities and to investor-owner companies for the purpose of providing public water supplies from streams and impounded reservoirs;

(2) water impoundments: power to impound surface waters for purposes of water supply, conservation, and recreation, and the power to set minimum release rates from water impoundments located in the state;

(3) dams: power to regulate the site, design, construction, and maintenance of dams on all streams in the state;

(4) encroachments: power to prevent or to remove any structure or fill within the channel or along the banks of any stream in the state. In the case of bridges and culverts, such power includes the authority to insure adequate waterway capacities for future floods;

(5) stream channels: power to control and regulate the location and cross section of any stream channel within the state for flood control and conservation purposes;

(6) water diversions: power to control the transfers of water between watersheds, regardless of purpose; and,

(7) water quality: power to protect any surface waters within the State from any active or potential sources of pollution.

The next political subdivision after the State is the county. In Pennsylvania, the county is subdivided into townships, of which there are two classes: first class, those that are generally urbanized and are found adjacent to cities, and second class, those that are generally rural. Incorporated urban centers are the cities, which are categorized by population into three classes, and boroughs.

Formal associations between political subdivisions and state water-related agencies are usually initiated by elected representatives, although at times local public petitions are used by smaller units, such as boroughs. Informal relations are usually limited to exchanges of information below policy-making levels. By far the largest share of formal relations is with urban centers, followed by first class townships. County governments are not organized to deal with water-related problems except for planning. Problems are handled in the townships. These units have frequently joined together with urban centers to form public corporations called authorities to simultaneously solve financing and regional problems.

COMMONWEALTH OF VIRGINIA

Virginia follows the reasonable use formula of riparian law with respect to water in natural streams. The Virginia courts have, over the years, evolved a doctrine which gives high priority to domestic uses, which are defined as uses to serve household needs, watering of livestock, and irrigation of the household gardens. This priority is so strong that a particular riparian owner is permitted to exhaust the flow of a stream in order to serve his domestic needs. Other uses, such as agricultural, industrial, and municipal are subject to the balancing concept of the reasonable use doctrine. The Virginia General Assembly has frequently legislated in the area of water resources, but has always been careful to express its intent that such enactments are not meant to modify common law riparian rights. The principal enactments are the Water Resources Act of 1972, the enactments of delegating various powers to localities, the Groundwater Act of 1973, and the State Water Control Law of 1946.

In essence then, power is basically with the localities-the cities, counties and towns-and only to the extent necessary to enable the localities to engage in the provision of water to their inhabitants. Localities are specifically granted the authority to engage in the business of water supply, and one or more localities may also accomplish this through several types of semi-autonomous bodies-sanitary districts, water authorities, and service districts (Virginia Code Annotated Secs. 21122.22 to 21.118.3, Repl. vol. 1975; Secs. 15.1-1239 to 15.1-1270, Repl. vol. 1973; Secs. 15.1-1420 to 15.1-1441, Repl. vol. 1973).

Cities and towns may regulate and inspect public and private water supply systems. They also have specific powers to provide and operate water supply systems, or to contract with others for the provision of such services. Counties, cities and towns may finance the establishment, extension, or improvement of water supply systems by issuing revenue bonds or general obligation bonds. The establishment or extension of water supply systems to serve three or more connections must be approved by the county in which the system is located.

The Virginia Water and Sewer Authorities Act authorizes the governing body or bodies of one or more political subdivisions to create by ordinance, or resolution, a water authority. An authority may acquire, construct, extend, operate and maintain any water system. Authorities also have the power to enter into contracts with the Federal government, the Commonwealth of Virginia and any of its agencies or instrumentalities, or with any unit, private corporation, association, or individual for the furnishing of water services to them or the provision of such services by them.

A reorganization of the State planning system through the Virginia Area Development Act of 1968 formed Planning District Commissions throughout the State. The Act listed two primary purposes of the Planning District Commissions:

1. To promote the orderly and efficient development of the physical, social and economic elements of the district by planning, and encouraging and assisting governmental subdivisions to plan for the future.

2. To prepare a comprehensive plan for the guidance of the development of the district.

The Commonwealth of Virginia is divided into 22 planning districts which are to serve as the fundamental local planning units for water quality and supply planning efforts.

In the Virginia Code, the term "public utility" includes those companies providing water or sewerage facilities either directly or indirectly to the public. Companies furnishing water or sewerage facilities to more than 50 customers cannot provide service without a certificate of public convenience and necessity from the State Corporation Commission. The application for the certificate must include detailed plans of the facilities and a statement of qualification to engage in such activities.

There are several agencies in the Commonwealth of Virginia that have water resources responsibilities. The two major regulatory agencies are the State Water Control Board and the Virginia Marine Resources Commission. Other agencies include the State Department of Health, the Commission of Game and Inland Fisheries, the Division of Parks, the Council on the Environment, the State Corporation Commission, and the Soil and Water Conservation Commission.

The State Water Control Board formulates policies, plans, programs, and regulations for development, conservation, utilization, and management of state water resources; enforces laws and regulations in the areas of water pollution control, water resources planning, and groundwater management; and provides advice on flood plain management. The Virginia Marine Resources Commission manages and regulates the wetlands, subaqueous lands, commercial fishery resources, and the use of the marine environment in the Tidewater Virginia area.

The Department of Health responsibilities include control over public water supplies, regulation of sewage disposal, control of seafood sanitation, and regulation of disposal of solid waste and toxic substances. The Commission of Game and Inland Fisheries manages all game and terrestrial forms of wildlife in Virginia and all freshwater fishery resources; and administers and enforces state boating laws to ensure safe operation within territorial limits. The Division of Parks (within the Department of Conservation and Economic Development) is involved in the planning aspects of scenic rivers. The Council on the Environment advises and coordinates all environmental policy; and reviews

policies for compatibility with the State's environmental policy. All of the above agencies are under the jurisdiction of the Secretary of Commerce and Resources with the exception of the Department of Health which is under the jurisdiction of the Secretary of Human Resources.

The State Corporation Commission is an independent agency concerned with the regulation of water supply and sewer companies and the approval for dams operated by a public utility. The Soil and Water Conservation Commission has established the Shoreline Erosion Advisory Service to advise property owners regarding shoreline stabilization.

STATE OF WEST VIRGINIA

Situated to the west of Chesapeake Bay, West Virginia contains and has jurisdiction over only a largely rural portion (24 percent) of the Potomac River watershed. The major water resource management agency is the Department of Natural Resources. The objective of the Department is to provide a comprehensive program for the exploration, conservation, development, protection, enjoyment and use of the natural resources of the State of West Virginia. The West Virginia Conservation Commission, formed in 1933, was the forerunner of the Department of Natural Resources, created by the Legislature July 1, 1961.

The State of West Virginia participates actively in the Interstate Commission on the Potomac River (ICPRB).

WATER RESOURCES ACTIVITIES IN THE STUDY AREA

Over the 17-year period that the Corps' Chesapeake Bay Study has been underway there have been numerous Federal, state and local water resources activities conducted in the Bay Region. Some of these activities and/or studies have been comprehensive examinations of the entire Region, while others have addressed only a small geographical area. The following paragraphs provide a brief overview of the major water resources activities that are the most relevant to water resources planning in the Chesapeake Bay Region.

CORPS OF ENGINEERS ACTIVITIES

METROPOLITAN WASHINGTON AREA WATER SUPPLY STUDY

The Metropolitan Washington Area Water Supply Study was a comprehensive examination of the water supply problems facing Washington, D.C. and seven surrounding counties in Maryland and Virginia. Severe water supply shortages had been forecast for the Metropolitan Washington Area, and the study was undertaken to identify and evaluate alternative methods of alleviating future deficits.

The study was initiated in 1976 and was conducted in two distinct phases over the course of seven years. The first, or early-action, phase examined the most immediate water supply problems and proposed solutions that could be implemented locally. A Progress Report describing the results of the early-action phase was released mid-way through the study (August 1979). This document was published so that decisions concerning high

priority water supply programs could be made as soon as possible. The second, or long-range, phase was completed in 1982 and included an analysis of the full spectrum of water supply alternatives available to the Metropolitan Washington Area. The Final Report contains a discussion of both the early-action and long-range phases of the study.

As the study progressed non-Federal agencies and organizations made great strides toward a regional solution to their water supply problem. These efforts were aided in large part by the Corps of Engineers' work. The most significant of the accomplishments to solve the water supply problem included a contract to purchase all water supply storage in Bloomington Lake, an agreement to construct the Little Seneca Lake project for the benefit of all of the major water service areas, endorsement of water conservation programs, and a commitment to cooperatively manage the entire water supply system as a single regional resource. With the implementation and continued execution of these programs and several others not mentioned, the water supply shortages once forecast for the Metropolitan Washington Area should be effectively eliminated through the year 2030, for the major water supply utilities (Washington Aqueduct, Fairfax County Water Authority, and Washington Surburban Sanitary Commission). Some of the smaller utilities surrounding the metropolitan area still face potential shortages before the year 2030, and the report suggests alternatives for their future consideration.

In light of the significant advances in regional cooperation among the major users, the region's recent commitment to certain high priority water supply programs, and the creation of local institutional mechanisms to implement these water supply programs, the District Engineer recommended that no additional water projects or programs be undertaken by the Corps of Engineers. He did recommend, however, that the Corps' report be transmitted to Congress as an information document in response to the authorizing legislation, Public Law 93-251.

PILOT ESTUARY WATER TREATMENT PLANT

Section 85b(2) of the Water Resources Development Act of 1974 directed the Corps of Engineers to study the feasibility of using the Potomac Estuary as a source of water supply. The authorization further directed the construction, operation, and evaluation of a pilot project for the treatment of estuary water. The purpose of the plant was to determine the feasibility of producing potable water from the Potomac River Estuary. The experimental plant was located on a two-acre site at the District of Columbia Blue Plains Water Pollution Control Plant. The plant was designed for a 1.0 mgd maximum flow rate with unit processes that, based on the present knowledge and technology, may produce treated water for many uses.

The overall objective of the project was to determine the technical and economic feasibility of using the Potomac River Estuary as a supplemental source of potable water in the MWA. Achieving these objectives required the answer to a number of key questions:

1. Using the best available analytical techniques, what quality of water can be produced by commonly used water treatment processes?

2. Is the water produced by the demonstration plant of potable quality?

3. What are the optimum process combinations which will ensure production of potable water at a minimum cost?

4. What is the operational feasibility and reliability of a water treatment plant that would be operated only intermittently?

5. Finally, what are the estimated costs of such a water treatment plant with hydraulic capacities of 100 and 200 mgd?

The project was designed to provide answers to the above questions. Cost constraints limited the project duration to three years, including approximately six months of plant start-up, two years of plant operation, and six months of plant deactivation and preparation of the final report. Based on the two years of plant operation, it appears technologically feasible to treat Potomac Estuary water to provide a potable water supply source. There may be some undetermined health risks, however, in using a source that is subject to discharges from large wastewater treatment plants and from many untreated non-point sources. The final report on the results of the testing was submitted to the Congress in 1983.

NORFOLK HARBOR AND CHANNELS STUDY

The Norfolk Harbor and Channels Study was authorized by the Senate Committee on Public Works Resolutions of 20 June 1969, and 24 June 1974, and by resolution of the House Committee on Public Works dated October, 1974. The study which was conducted by the Norfolk District of the Corps, was initiated in 1971 and completed in 1980. The report is presently under review at higher authority within the Corps.

In the current survey investigation, consideration is being given to deepening the existing 45-foot channels serving the Port of Hampton Roads to a depth of 55 feet and providing additional and/or improved anchorage areas. In addition, consideration is being given to deepening the existing 40-foot channel on the Elizabeth River and the Southern Branch to 45 feet and the existing 35-foot channel on the Southern Branch to 40 feet up to the Gilmerton Bridge. Testing was conducted on the Chesapeake Bay Hydraulic Model in connection with the proposed deepening.

BALTIMORE HARBOR AND CHANNELS STUDIES

The proposal for deepening Baltimore Harbor and its approach channels began with a 1958 resolution of the Committee on Public Works of the House of Representatives. The June 1969 review report prepared under the above resolution resulted in a 1970 authorization for a project. The authorized project consists of deepening channels in both the Virginia and the Maryland portions of the Chesapeake Bay. The Virginia channels, which consist of the Cape Henry, York Spit, and Rappahannock Shoal channels, will be deepened to 50 feet. In the Maryland portion, the main approach channels from the mouth of the Magothy River to Fort McHenry and the Curtis Bay Branch Channel will be deepened to 50 feet, while the Northwest Branch Channel, divided into an east and west channel, will be deepened to 49 feet and 40 feet respectively. Material dredged from the Rappahannock Shoal and York Spit channels will be placed overboard in previously used disposal areas in the Bay. Some material from the Cape Henry Channel will be placed at Fort Story for future beneficial reuse, while the remainder will be placed in one of two approved ocean sites. All the material from the Maryland channels

will be placed in the State's Hart-Miller Island diked disposal area.

The Baltimore District completed the draft combined Phase I-II General Design Memorandum (GDM) and draft Environmental Impact Statement (EIS) for the authorized project in May 1981. It should be noted that testing was conducted on the Chesapeake Bay Hydraulic Model as part of the analysis for the GDM and EIS. A public meeting was held in June 1981 for soliciting views and comments from interested parties, as well as for compliance with Section 404(b) of the Clean Water Act of 1977. The final GDM and EIS were circulated to the public for review and comments in September 1981. A Supplemental Information Report (SIR) which addressed all oral and written comments presented at the public meeting, was prepared and circulated as information to all parties which had received the final report. The final EIS and GDM were forwarded to Congress by the Secretary of the Army in March 1982. Surveys, drilling and testing, and preparation of plans and specifications together with environmental monitoring in Virginia waters will be performed during 1983.

OTHER CORPS STUDIES SPECIFICALLY AUTHORIZED BY CONGRESS

In addition to the previously mentioned studies, there were several other major studies conducted while the Chesapeake Bay Study was underway. None of these studies required hydraulic model testing; however, there was a mutual exchange of data among the various programs. These studies are listed as follows:

- Norfolk Harbor, Craney Island Study
- South Branch, Elizabeth River Study
- Delaware Estuary Salinity Intrusion Study
- Willoughby Spit Study
- Smith Island Study
- Hampton Roads Drift & Removal Study
- Newport News Disposal Area Study
- Virginia Beach Study

CONTINUING AUTHORITIES PROGRAM

The Secretary of the Army, acting through the Chief of Engineers, is authorized to plan, design, and construct certain types of water resource improvements without specific Congressional authorization. Such improvements come under the heading of the "Continuing Authorities Program." The legislation for this program specifies Federal cost limitations for each separate project authority. Each project selected must also be economically justified, complete within itself, engineeringly feasible, and environmentally acceptable. The Continuing Authorities Program consists of several legislative authorities including the Small Flood Control Project Authority, authorized by Section 205 of the Flood Control Act of 1948, as amended; Small Navigation Project Authority, authorized by Section 107 of the River and Harbor Act of 1960, as amended; Small Beach Erosion Control Project Authority, authorized by Section 103 of the River and Harbor Act of 1962, as amended; Authority for Snagging and Clearing for Flood Control, authorized by Section 208 of the Flood Control Act of 1954, as amended; Authority for Emergency Streambank and Shoreline Protection of Public Works and Non-profit Public Services, authorized by Section 14 of the Flood Control Act of 1946, as amended; Authority for Snagging and Clearing for Navigation, authorized by Section 3 of the River and Harbor Act of 1945; and Authority for Mitigation of Shore Damages attributable to Navigation Projects, authorized by Section 111 of the River and Harbor Act of 1968.

In the Chesapeake Bay Region, planning under the Continuing Authorities Program has led to authorization and construction of numerous beach erosion control, flood control, and

navigation projects. Studies have also produced, in many instances, data that local and state level agencies have used to implement their own solutions to water resource problems. These have generally occurred where solutions exist, but Federal interest is lacking due to lack of economic justification or where non-Federal interest desires more rapid implementation than is possible through the Federal planning process. There are in existence, other Federal and state programs which have similar missions to those granted to the Corps under the Continuing Authorities Program. Through extensive coordination during the planning process and in accordance with formal agreements, every effort is made to eliminate duplication of efforts. As a result, the respective programs complement each other in that certain non-Federal programs can be used to both fund non-Federal shares of project costs as well as to implement solutions where Federal involvement is not warranted.

PERMIT ACTIVITIES

Under the law of the United States, Congress has given the Corps of Engineers regulatory responsibility to protect navigation channels and harbors against encroachment (Sections 9 and 10 of the Rivers and Harbors Act of 1899), and more recently to restore and maintain water quality by regulating the discharge of dredged or fill material in coastal and inland waterways and wetlands. The basis for the Corps of Engineers' responsibility to regulate the disposal of dredged or fill material is Section 404 of the Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500). The purpose of this program, which is part of the Corps of Engineers overall regulatory authority, is to insure that the chemical/biological integrity of waters of the United States is protected from the irresponsible and unregulated discharges of dredged or fill material that could permanently destroy or alter the character of valuable water and related resources. This program provides for the consideration of all concerns (environmental, social, and economic) in the Corps' decision to either issue or deny permits.

OTHER FEDERAL ACTIVITIES

ENVIRONMENTAL PROTECTION AGENCY CHESAPEAKE BAY PROGRAM

In fiscal year 1976, Congress directed the Environmental Protection Agency to conduct a five-year $25 million study of the environmental quality and management of Chesapeake Bay resources. Through this study, known as the Chesapeake Bay Program, the EPA was directed to coordinate research to assess the principal factors adversely impacting the Bay's water quality by coordinating pollution research to analyze, store, and distribute research data; and to determine which government agencies have resource management responsibilities and ways to optimize coordination among them.

Existing Bay research and management activities involve a broad spectrum of interests and jurisdiction from Federal, state, and local government agencies to research institutions, commercial interests, and the public. In recognition of this diversity of concerns, EPA designed its program to facilitate a cooperative and coordinated approach towards assuring the Bay's protection.

To assure the continuance of the cooperative effort represented by the Chesapeake Bay Program, EPA encouraged state (Maryland, Virginia, and Pennsylvania) participation in all aspects of the program. This enabled EPA to receive assistance and support from state agencies in the areas of program planning, technical support, data compilation and

processing, scientific planning, and technical program development and implementation. The lead agency in Maryland was the Water Resources Administration of the Department of Natural Resources. Its counterpart in Virginia was the Virginia State Water Control Board, and in Pennsylvania, the Department of Environmental Resources in conjunction with the Susquehanna River Basin Commission. These agencies served as liaisons between the Chesapeake Bay Program and other stage agencies. This interactive effort was accomplished through the participation of state personnel on program policy, management, and working level committees.

The Chesapeake Bay Program was designed to complement current environmental studies being done by other agencies, institutions, and citizens groups. Its objectives were to describe historical trends and to help determine the current state of the Bay by evaluating ongoing research and providing new research efforts to fill in the missing pieces. The Program also projected future conditions and used this information to develop and identify control and management strategies for Bay resources and to develop implementation plans for these strategies.

The three principal areas of focus for the EPA study were 1) the presence of toxic substances, 2) nutrient enrichment, and 3) the disappearance of valuable submerged aquatic vegetation.

The EPA study was completed in 1983. A list of the final products of the study includes:

Final reports on individual research projects, with summaries of each report.

Descriptions of the Program's computer model of the Chesapeake Bay system.

Chesapeake Bay: Introduction to an Ecosystem—explains important ecological relationships and serves as a reference for the synthesis report, the characterization report, and the CBP management alternatives.

Chesapeake Bay Program Technical Studies: A Synthesis—summarizes and explains the technical knowledge gained from the researc. projects funded by this program in the areas of nutrient enrichment, toxic substances, and submerged aquatic vegetation. It provides an understanding of the processes which affect the quality of Chesapeake Bay.

A Profile of Environmental Change—Assesses trends in water quality and living resources over time, and examines relationships between the two.

A Framework for Action—Identifies control alternatives for agriculture, sewage treatment plants, industry, urban runoff, and construction; estimates costs and effectiveness of different approaches to remedy "hot spots."

Findings and Recommendations—A short summary of the program and its findings and recommendations.

U.S. GEOLOGICAL SURVEY POTOMAC ESTUARY STUDY

The U.S. Geological Survey (USGS) is making an interdisciplinary study of the Tidal Potomac River and Estuary. This study blends USGS research with river quality assessments in the study of an estuarine environment. The overall goal is to understand the major aspects of hydrodynamic, chemical, and biological processes and their interaction in a tidal river-estuarine system. The study started in 1977 with the first field data collection efforts and was completed in 1983.

STATE ACTIVITIES

BI-STATE WORKING COMMITTEE FOR CHESAPEAKE BAY

The Governors of the Commonwealth of Virginia and the State of Maryland signed an agreement in August 1979, establishing the Bi-State Working Committee for Chesapeake Bay and coastal areas. The purpose of this Committee is to provide a forum through which common administrative and management problems could be approached and resolved. It is an arm of the executive branch of the state governments and, consequently does not actively formulate and submit legislation. Rather, it advises the Bi-State Commission (a commission formed by the legislature) on the need for changes to existing laws or new laws. Committee members are responsible to the Secretaries of Natural Resources for each state. The Committee was very supportive of the Chesapeake Bay Model and through its efforts, the Virginia delegation entered into the Congressional record a statement supporting continued operation of the model after the completion of the Corps studies.

CHESAPEAKE BAY COMMISSION

The Chesapeake Bay Commission was created by the 1980 General Assemblies of the State of Maryland and the Commonwealth of Virginia (Maryland Annotated Code, Article NR Sec. 8-302; Code of Virginia, Sections 62.1-69.5 to 62.1-69.20). The creation of the Commission was the culmination of an effort begun two years earlier, when the Chesapeake Bay Legislative Advisory Commission was created by the Maryland and Virginia General Assemblies to examine ways in which intergovernmental coordination in management of the Chesapeake Bay could be enhanced.

The primary purposes of the Commission are to assist the legislatures of the two states in responding to problems of mutual concern, and encourage cooperative coordinated planning and action by the signatories and their executive agencies.

The duties of the Chesapeake Bay Commission are to:

- identify specific Bay management concerns requiring intergovernmental coordination and cooperation;
- recommend to the states and/or to the Federal and local governments legislative and administrative actions necessary to effectuate coordinated and cooperative management of the Bay;

- collect, analyze and disseminate information pertaining to the region and its resources for the respective legislative bodies;

- represent the common interests of the signatories as they are affected by the activities of the Federal Government, and assist in monitoring those activities; and,

- provide an arbitration forum to serve as an advisory mediator for bi-state conflicts.

The commission maintains an office and staff in Annapolis, Maryland. The staff is available to assist any member of the General Assembly of either state on any matters pertaining to Chesapeake Bay.

STATE OF MARYLAND FLOWBY STUDY

In 1978, the Potomac River Low Flow Allocation Agreement was developed to provide an interjurisdictional mechanism for allocating water among the various Potomac water suppliers during periods of critical low flow. Signatories to the "Agreement" include the United States of America acting by the Secretary of the Army through the Chief of Engineers, the State of Maryland acting by the Governor and the Secretary of the Department of Natural Resources, the Commonwealth of Virginia acting by the Governor and the Chairman of the State Water Control Board, the District of Columbia acting by its Mayor, and the Washington Suburban Sanitary Commission acting by its chairman, and the Fairfax County Water Authority acting by its chairman. The portion of the Potomac covered by the "Agreement" extends from Little Falls Dam to the farthest upstream limit of the pool of water behind the Chesapeake and Ohio Canal Company rubble dam at Seneca, Maryland.

The need for maintaining sufficient water in the Potomac to protect in-stream values during periods of critical natural low flow is established in Article 2.C of the "Agreement". Article 2.C reads in part as follows:

> In calculating the amount of water available for allocation, the Aqueduct will determine, in consultation with the parties, and based upon then current conditions and information, any amount needed for flow in the Potomac River downstream from the Little Falls dam for the purpose of maintaining environmental conditions (environmental) flow-by) and shall balance such need against essential human, industrial and domestic requirements for water. The Aqueduct's determination shall be based upon the data and shall give substantial weight to conclusions for environmental flow-by submitted by the State (of Maryland).

In July of 1978, the U.S. Army Corps of Engineers developed a Memorandum of Intent for clarification of the environmental flowby/allocation formula portion of the "Agreement". The Memorandum of Intent stated that:

...the Washington Aqueduct will include along with the amount of water withdrawn from the subject portion of the river that amount designated as the environmental flowby. Thus, when the Washington Aqueduct determines that the amount withdrawn, combined with the environmental flowby amount, is equal to or greater than eighty (80) percent of the total daily flow, the Restriction Stage will be put into effect and allocation will begin.

Article 2.C established the primary "charge" and objective of the environmental flowby study conducted by the State of Maryland—that is, the development of "conclusions" (environmental flowby recommendations and impact associated with low flows) for the establishment of an "amount needed for flow in the Potomac River downstream from Little Falls dam for the purpose of maintaining environmental conditions." Beyond the primary study "charge" and objective, data collection and analysis was expanded in an effort to make a thorough examination of low flow effects on a broad range of environmental values and recreational activities from Seneca Pool to Little Falls, including a portion of the extreme upper estuary. Expansion of the study scope provided an information base that will enable the development of future management alternatives for the Potomac beyond the immediate and necessary need for the establishment of a flowby below Little Falls dam.

During the early phase of study design it was determined that only the lower fluvial portion of the Potomac (between Little Falls and Seneca Pool) would be measurably affected by potential low flows and water withdrawals. Previous Federal and state modeling efforts, as well as, some modeling done in conjunction with the flowby study, indicate that the tidal Potomac Estuary is not adversely affected by cyclic low flow conditions. Thus, the data collection and analysis focused on the fluvial Potomac.

Primary data collection for the study was conducted in the summers of 1978 and 1980 during periods of low flow. The final report to include the recommended flowby was completed in December 1981. The principal recommendation of the study as it relates to Chesapeake Bay was that a minimum flow of 100 mgd be maintained into the Potomac Estuary during even the most severe droughts. This recommendation for a minimum flow-by of 100 mgd was subsequently adopted by the signatures to the LFAA.

OTHER STATE ACTIVITIES

It should be noted that the states, most particularly Maryland and Virginia, have numerous on-going studies and programs relative to the water resources of the Bay Region. Because of the extensive nature of these activities it is suggested that the reader direct inquiries to the states for the most current inventory of state studies and/or programs.

WATER RESOURCES PROBLEMS AND NEEDS

INTRODUCTION

Water resources problems and needs in the Chesapeake Bay Region were identified and discussed in detail in the Chesapeake Bay Future Conditions Report (FCR). The following sections summarize the significant findings of the FCR. As noted earlier, the projections of population and economic activity used in the future problems and needs analysis were based on the Series C OBERS projections of population, income, earnings, and manufacturing output prepared by the Department of Commerce and the Department of Agriculture. A special set of projections coinciding with the Chesapeake Bay Study Area was prepared by the Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce.

After the initiation of the future conditions phase of the Chesapeake Bay Study, another set of baseline projections derived from more recent economic and demographic data was prepared and released by BEA. These new projections were called the "Series E" OBERS projections. Due to time limitations, however, Series E projections were not used in the FCR. In general, the Series E projections of population and economic activity are less than the comparable Series C figures. For more detailed information concerning the problems and needs discussed below, please refer to the appropriate appendix of the FCR.

WATER SUPPLY

Water is required to meet the needs of the many communities, industries, and agricultural activities that exist in the Study Area. The total use of water from streams, rivers and reservoirs and from subsurface aquifers (ground water) to meet these needs averaged about 2,470 million gallons per day (mgd) in 1970, (see Figure A-9). Approximately 96 percent of the total was used in municipal and industrial systems. Of this, 900 mgd was brackish water used in industrial processes, and 122 mgd was municipal wastewater reused in industrial cooling processes. The balance of the water was used by people living in rural areas for domestic purposes, livestock and poultry production, and irrigation.

Of the Study Area's 7.9 million residents in 1970, approximately 6.5 million, or 82 percent, were served by public water supply systems. These systems ranged in size from those serving as few as 20 persons in small developments to large municipal systems serving commercial, institutional and industrial establishments and millions of individuals. Total water use provided through the central systems was 868 mgd in 1970.

Water for use in manufacturing (industrial water supply) totaled 1,620 mgd in 1970, including water from surface fresh and brackish water sources, ground water, and public water supply systems. Of interest is the fact that 99 percent of the total water intake was used by only 3 percent of the approximately 4,800 manufacturing establishments in the Bay Region. In addition, water use was concentrated within specific types of industries—82 percent of gross water use was accounted for by three groups of industries: paper and allied products, chemicals and allied products, and primary metals. Rural domestic water supplies are required to serve the needs of persons that live in rural locations and that are not served by central water supply systems. Of the

almost 1.4 million who lived in rural areas in 1970, about 7 percent resided on farms. The non-farm component of the population included a substantial number of persons that lived in the suburbs of the major metropolitan areas. The total water use for rural domestic purposes amounted to approximately 63.1 mgd in 1970, or about 3 percent of all water use in the Bay Region.

Water for livestock and poultry includes the supply necessary for sustenance of the beef and dairy cattle, sheep, hogs, horses, chickens, and turkeys, as well as the water necessary to produce farm products for the market place. In the Chesapeake Bay Region, livestock and poultry water consumption amounted to 14.7 mgd in 1967, or less than 1 percent of all uses Bay-wide.

The amount of water used for irrigation purposes in the Study Area amounted to 8 billion gallons in 1969. This was applied to only about 2 percent of the total land in crops, indicating the relative unimportance of agricultural production in the Bay area. The major irrigated crops, in terms of acreages, were corn, small grains, cropland/pasture, and other field crops (39 percent), vegetables (52 percent), and nursery and other crops (9 percent).

Future increases in water supply demand will occur in the Study Area in conjunction with projected population and economic growth. Demands for water supplied through central systems, for example, have been projected to increase by approximately 170 percent Bay-wide by 2020 (see Table A-13). The Baltimore and Washington SMSA's are expected to account for the largest share of the centrally supplied water at 75 percent of the total demand in both 2000 and 2020.

TABLE A-13
AVERAGE CHESAPEAKE BAY AREA
WATER SUPPLY DEMANDS
(Million Gallons Per Day)

	1970	1980	2000	2020
Municipal	870	1,090	1,590	2,320
Industrial	1,620	1,580	1,400	1,820
Agricultural*	160	480	900	1,470
TOTAL	2,650	3,150	3,890	5,610

* Includes irrigation use during a dry year.

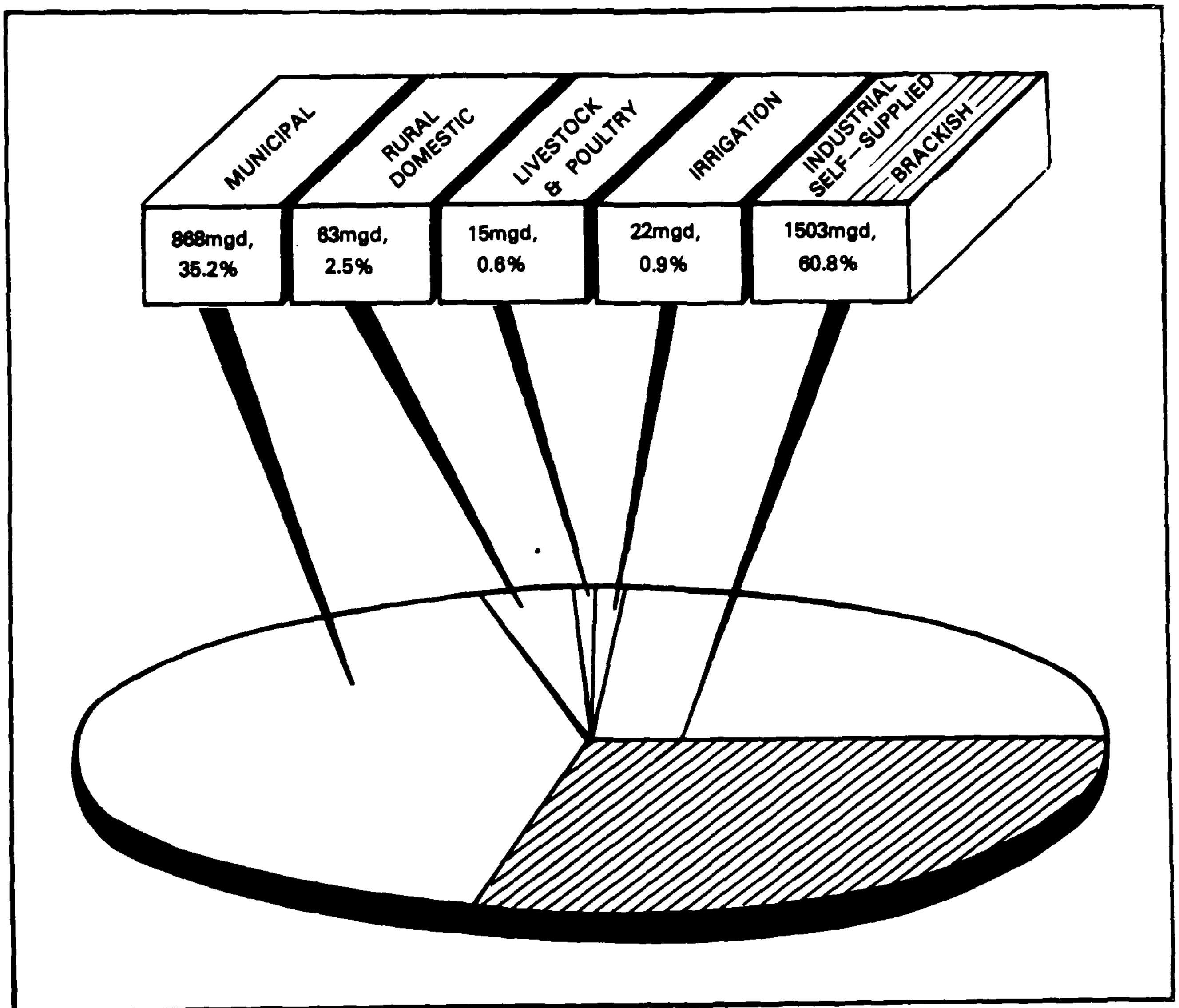


FIGURE A-9 AVERAGE WATER USE BY TYPE IN THE CHESAPEAKE BAY

Industrial water withdrawals are expected to experience a 13 percent decline between 1970 and 2000 from 1,620 to 1,400 mgd, as shown in Table 3. This is due to expectations of increased recycling within industry in order to reclaim waste products and/or aid in achieving goals for water pollution control. By 2020, industrial withdrawals are projected to reach 1,820 mgd. The amount of water actually used in industrial processes as a proportion of the amount of water actually withdrawn (the recycling rate) is projected to increase from 1.6 at present to about 9.5 in 2020.

Future increases in agricultural water use shown in Table A-13 are due primarily to irrigation during a "dry year." These demands would account for a full 92 percent of the agricultural use in 2020. A major portion of the increase in total irrigation demand in the Study Area over the projection period is due to increases in the corn acreage and the proportion of corn acreage irrigated. Slightly over one-half of the irrigation in 2020 would occur on the Eastern Shore of Maryland.

The rural domestic component of water requirements is projected to increase 67 percent to about 100 mgd over the 50-year study period. Non-farm water use in the suburban areas is expected to be by far the largest component of total rural domestic water use in the future, accounting for 97 percent by the year 2020.

Future water use for livestock and poultry is expected to decline slightly by 1980 and then remain fairly constant at about 12 mgd through the balance of the study period. Although slight increases are projected in the rural counties near Baltimore and on the Eastern Shore portion of the Study Area, an overall decline of about 19 percent is anticipated through 2020.

An analysis of the available developed water supply capability of 48 communities in the Bay Region was used to identify potential water shortages. During a hypothetical 30-day maximum demand period, occurring during the driest year in 50, a deficit of 47 mgd was identified for 24 communities in 1980. This deficit increases, however, to 396 mgd for 35 communities in 2020. Table A-14 shows the water service area supply deficits for communities in the Chesapeake Bay Region for 1980, 2000, and 2020.

Certain problems occur in conjunction with the provision of water for the people, industries, and farms of the Bay Region. Growing affluence and economic development, with accompanying increases in demands for water, will require expansion of water systems and water source development. In most urban areas that are located on or near the tidewater portions of the Bay, such as Baltimore, Newport News, Norfolk, and Portsmouth, nearby sources of freshwater have long since been developed. Increased competition for new sources at longer distances from the urban centers is thus occurring. The economic, institutional, and engineering problems associated with these large-scale projects are substantial.

Seasonal variations in flow and longer-term cyclical trends in climate and hydrology can cause problems for systems dependent for their supply on surface water. For example, the periods of highest demand for water often coincide with the lowest river flow in Washington, D.C., where supplies are obtained primarily from the Potomac River. The low flow of record, which occurred in 1966, would not be sufficient to meet today's maximum demands.

TABLE A-14
WATER SERVICE AREA SUPPLY DEFICITS

Water Service Area	Deficits In The Existing Source of Water		
Maryland	1980	2000	2020
Aberdeen	4.1	10.8	20.6
Annapolis	1.5	2.6	3.2
Baltimore	0.0	0.0	72.0
Bel Air	1.1	2.8	4.4
Cambridge	0.9	1.8	3.2
Centreville	0.0	0.0	0.2
Chestertown	0.3	0.6	1.0
Crisfield	0.5	0.6	0.8
Crofton	0.4	1.2	1.3
Delmar	0.0	0.0	0.0
Denton	0.0	0.1	0.2
Easton	0.3	1.4	3.0
Edgewood (Perryman)	1.2	4.1	9.3
Elkton	0.0	0.0	0.0
Havre de Grace	0.0	0.0	0.0
Joppatowne	0.1	0.2	0.5
King's Heights (Odenton)	1.0	1.7	2.3
Leonardtown	0.0	0.0	0.0
Lexington Park	0.7	3.9	10.0
Maryland City	1.4	2.9	4.8
Pocomoke City	0.0	0.1	0.5
Princess Anne	0.0	0.1	0.4
Salisbury	0.0	0.6	2.0
Severna Park (Severndale)	4.0	5.0	9.3
Snow Hill	0.0	0.2	0.6
Sykesville-Freedom	0.0	0.1	1.0
Westminster	0.1	1.0	1.8
Waldorf	0.6	4.0	10.4
Washington Metropolitan Area			
Washington Suburban Sanitary Commission	0.0	0.0	0.0
Washington Aqueduct	0.0	0.0	0.0
Alexandria, Va.	0.0	0.0	0.0
Fairfax County Water Authority	0.0	0.0	0.0
Goose Creek (Fairfax City), Va.	6.8	27.6	63.1
Manassas, Va.	0.0	2.0	3.4
Manassas Park, Va.	0.2	1.8	4.3

TABLE A-14 (cont'd)
WATER SERVICE AREA SUPPLY DEFICITS

Water Service Area	Deficits in the Existing Source of Water		
Delaware	1980	2000	2020
Seaford	0.0	0.3	1.3
Virginia			
Ashland	0.0	0.0	0.0
Colonial Heights-Petersburg	0.0	0.0	0.0
Fredericksburg	0.0	0.0	0.0
Hopewell	8.6	15.3	35.6
Mechanicsville	1.0	4.3	11.0
Newport News	4.2	0.0	21.0
Norfolk	1.0	26.4	57.0
Portsmouth (Incl. Suffolk)	4.0	15.0	29.2
Richmond	0.0	0.0	0.0
Smithfield	0.0	0.3	0.9
West Point	0.0	0.0	0.0
Williamsburg	3.0	4.7	7.0

Sources of water supply that become degraded are also a major problem for water users in the Bay area. Surface waters, both reservoirs and free-flowing streams, are especially susceptible to pollution from municipal and industrial waste discharges, agricultural activity, and other upstream sources. Water supply systems which are dependent on ground water as their source are also susceptible to contamination. Seepage from septic systems and landfills are notable sources of pollution in ground water supplies, and saltwater intrusion is another problem affecting some areas around the Bay.

Conflicts also arise in attempts to develop new water supply sources. On-stream reservoirs and pumped storage reservoirs are solutions to requirements for surface water development, but increased competition for land and other economic, social, institutional, technical, and environmental problems must also be considered in the planning effort. Also, there is concern at several levels of society regarding proposals for large scale water diversions to serve the major water-short areas. Diversion of water from one watershed to another causes direct reduction of streamflow by the amount withdrawn, and may generate problems in the depleted reaches of the river.

One of the most significant problems associated with reduced or low freshwater inflows is the increase in salinities which may prove to have serious detrimental effects on the Bay's ecosystem. For example, prolonged periods of depressed inflows due to man-related modifications or drought may destroy valuable grasses, alter the spawning patterns and range of finfish, change the distribution of shellfish in the Bay, or permit diseases and predators to extend further into the Bay. In addition, the social and economic integrity of the Bay and its tributaries may be adversely affected. The location of commercial fishing areas may be altered with higher salinities, which could

affect the livelihood of many of the Bay's watermen. Finally, increased salinity regimes could adversely affect those industries which require water of relatively low salinity for their cooling and processing activities. The exact effects of low freshwater inflow on the Bay are not presently known. The severity of the problem, however, is expected to increase substantially with potential increases in consumptive losses in the major tributaries feeding Chesapeake Bay. As will be discussed in more detail later, the problems associated with low freshwater inflows were selected for detailed analysis in the final phase of the study.

WATER QUALITY

Water quality is the term used to describe the biological, chemical, and physical condition of the water in a river, bay, ocean, or underground. What is termed as "good" water quality differs depending on the intended use. Man requires water for drinking that is free of color, pathogenic bacteria, and objectionable taste and odor. Industries, which use water primarily for cooling and steam production, require water free of materials such as chlorides, iron, and manganese which may be harmful to equipment. Agriculture requires still a different quality of water that is free of degrading materials toxic to plant and animal life. Finally, each form of aquatic life requires water of varying qualities in order to assure its healthy existence.

Water quality problems generally arise when the waste loads imposed by man exceed the water's capacity to assimilate them adequately. The resulting degradation can be very costly, both economically and ecologically. Increased cost of water treatment for municipal and industrial use, the closing of shellfishing areas and the resulting income loss for persons employed by the fishing industry, the loss of valuable recreation areas, the degradation of aesthetic values, the corrosion of structures exposed to water, destruction of fish and wildlife habitats, and the general reduction in the use of receiving waters are all costs of polluted waters.

Characterizing the quality of Chesapeake Bay's waters is difficult because of the wide variety of conditions encountered in an area of this size. As quoted from the findings of EPA's Chesapeake Bay Program:

> "Chesapeake Bay Program findings clearly indicate that the Bay is an ecosystem with increasing pollution burdens and declines in desired resources. It is also evident that actions throughout the Bay's watershed affect the water quality of the rivers flowing into the Bay. Degradation of the Bay's water and sediment quality can, in turn, affect the living resources. Thus, effective management of the Chesapeake Bay must be based on an understanding of, and an ability to control both point and nonpoint sources of pollution throughout the Chesapeake Bay basin."

The most severe water quality problems occur in the tributaries near areas of high population concentrations. Figure 10 summarizes the major water quality problems of the larger tributaries. In general, municipal and industrial wastes have been found to be the major problems in the populated areas of Baltimore, Washington, Richmond, and Norfolk. Other less populated areas suffer mainly from agricultural and land runoff as well as smaller amounts of municipal discharges. As noted above, the overall system is being impacted by the collective pollutants and nutrients from its tributaries.

MUNICIPAL WASTEWATER.

Increasing levels of population and per capita income in the Chesapeake Bay Region will mean increased municipal wastewater volumes. As shown in Table A-15, the future wastewater flows (as projected in the Future Conditions Report) exceed the 1975 treatment plant capacity in all of the river basins for which projections were available.

In addition to the need for more capacity, treatment plants providing more advanced treatment of the wastewaters will be required in most areas of the Bay Region in order to meet the requirements of the Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500).

TABLE A-15
FUTURE MUNICIPAL WASTEWATER TREATMENT NEEDS

River Basin	Projected Flow Year	Projected Flow (mgd)	Existing Capacity (mgd, 1975)	Deficit (mgd)
Lower Susquehanna	1995	3.27	1.87	1.40
Patapsco	1990	261.60	238.76	22.84
West Chesapeake	2000	32.80	19.40	13.40
Patuxent	2000	96.30	39.40	56.90
Washington Metro.	2000	543.80	344.64	199.16
Northern Virginia	2020	363.30	111.98	251.32
Rappahannock	2020	19.54[1]	8.38	11.16
York	2020	39.60[1]	2.98	36.62
James (Lower)	2020	386.00[1]	163.97	222.03
Accomack-Northampton	2000	1.26	.74	0.52
Pocomoke	2000	3.00	2.65	0.35
Nanticoke	1995	13.56	12.80	0.76
Elk	1995	4.99	3.40	1.59

[1]Based on total population and not population served.

INDUSTRIAL WASTEWATER.

Industrial discharges will have a great bearing on the achievement of water quality management goals in the future, especially in highly industrialized areas such as Baltimore, Richmond-Hopewell, and Norfolk. The industrial discharge projections presented in Figure A-11 are median range values which balance projections reflecting simple historical data on one hand and maximum attainable recycling technology on the other. The curve shown in Figure A-11 shows that, while recycling rates will indeed continue to improve, it is more likely that a lesser degree of implementation of technology in industrial water reuse will occur. Although the discharge projections do not specifically address actual concentrations of waste projects or projected discharge loadings, they do serve as an indicator of the marked decrease in industrial discharges that may be expected in pursuit of National water quality goals.

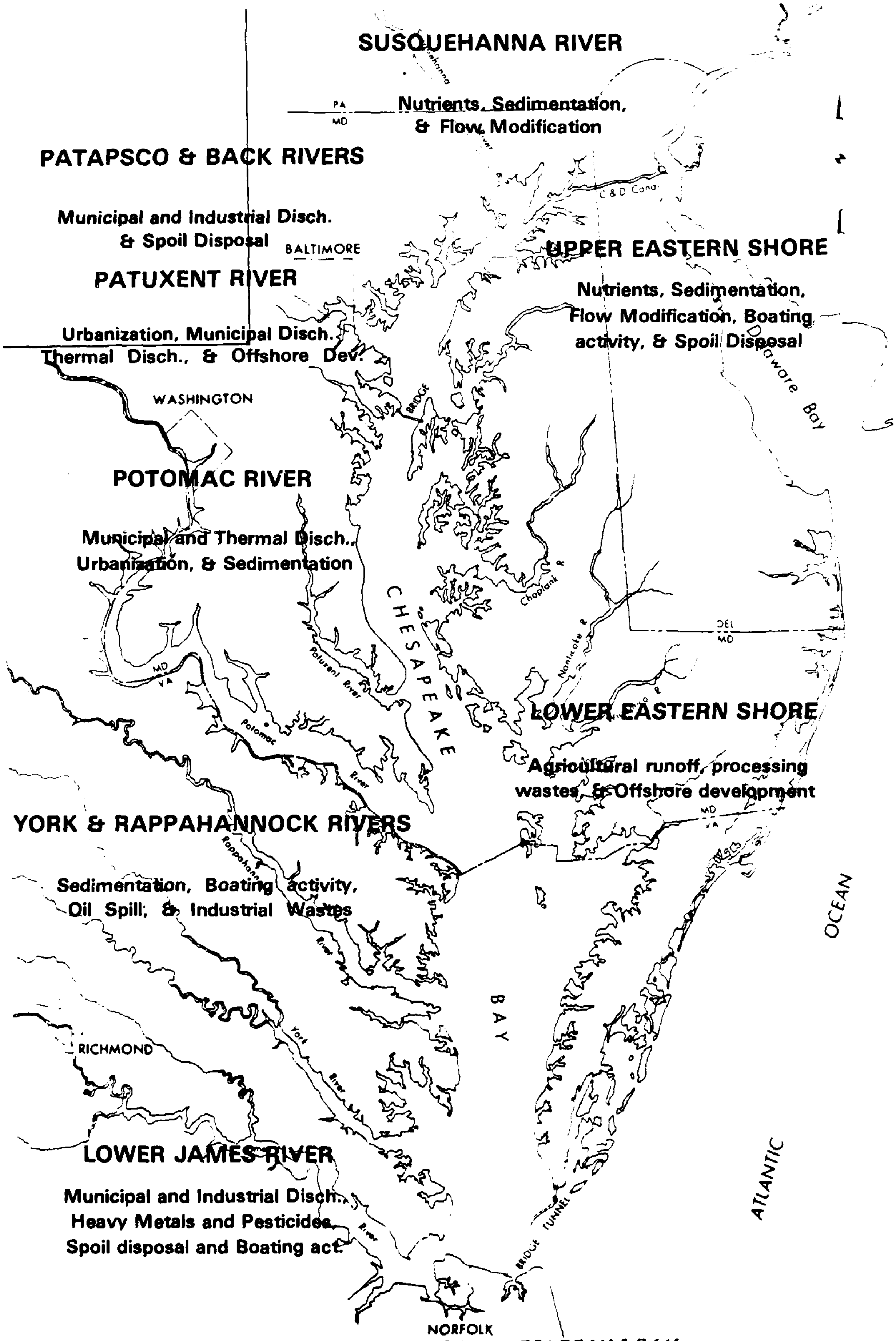


FIGURE A-10 WATER QUALITY PROBLEMS IN CHESAPEAKE BAY

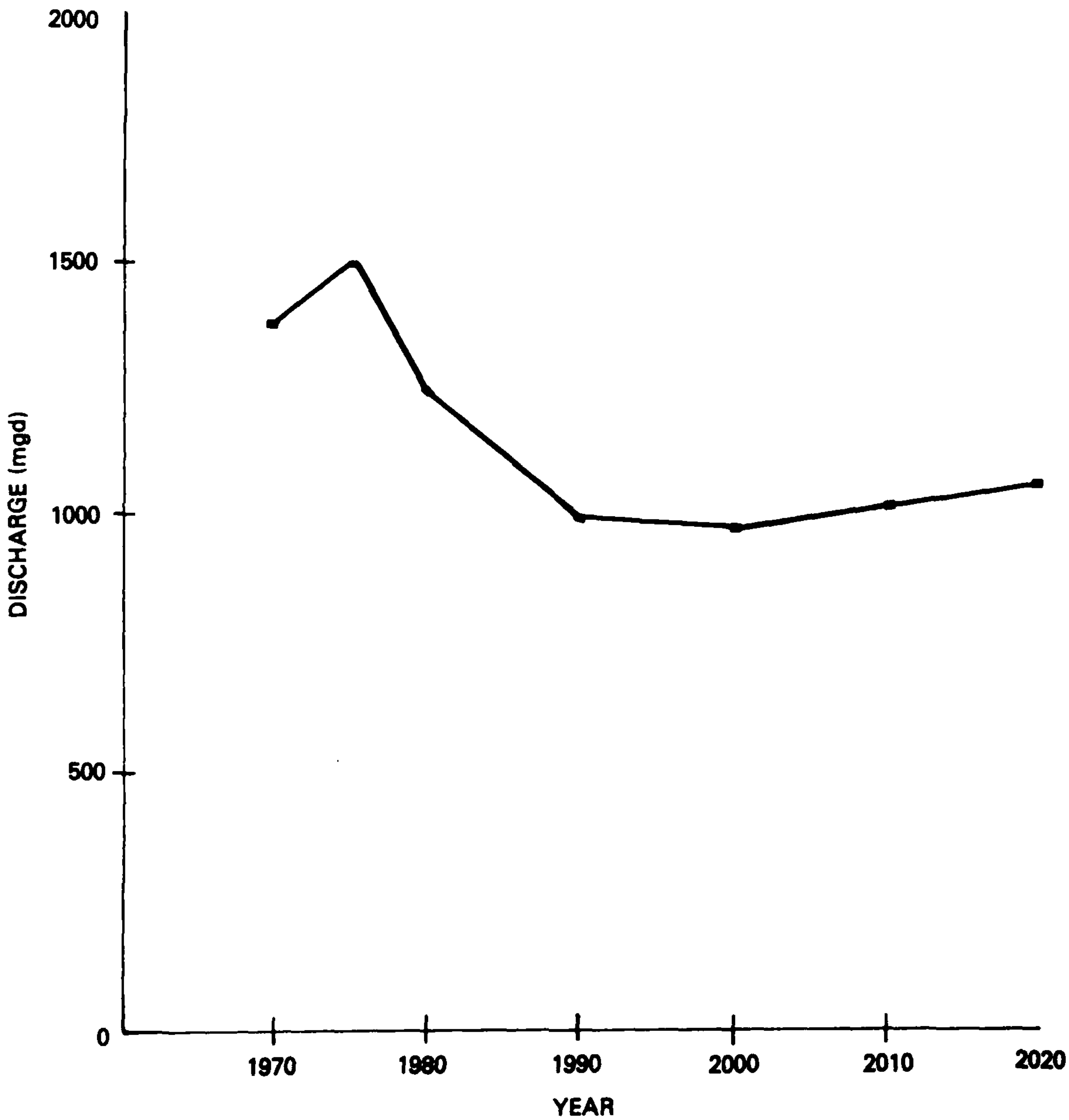


FIGURE A-11 INDUSTRIAL DISCHARGE PROJECTIONS FOR THE CHESAPEAKE BAY REGION WITH MODERATE TECHNOLOGY (MGD)

THERMAL DISCHARGES.

Increases in the demand for electric power will create the additional problem of the disposal of heated cooling waters. Withdrawals for 1980 were 8,500 mgd. A major concern is the effect such heavy concentrations of heated waters will have on the aquatic environment.

AGRICULTURAL AND URBAN RUNOFF.

With approximately 40 percent of the Bay's land area in agricultural use, polluants such as nutrients, pesticides, sediment, and animal waste products can be expected to continue to contribute a significant loading. Although the percentage of land in agricultural use is projected to decrease, intensive farming practices which attempt to grow the same or greater amounts of crops on smaller land areas may contribute even greater loadings than before. Urban runoff may be expected to increase markedly as population growth and urban expansion continues.

OIL AND MARINE TRANSPORTATION SPILLS.

With the projected increase in both total traffic and the total amount of oil products shipped on Chesapeake Bay, the probability of accidental spills may also increase. Other hazardous chemicals in transport will also be subject to accidental spills as Bay traffic increases.

SEDIMENTATION.

Sedimentation, a natural phenomenon the level of which has been increased due to man's activities, can also be expected to increase in the future as population grows in the Bay Region. A projected doubling of population in the Chesapeake Bay Region between 1970 and 2020 means that the existing number of residences, office buildings, and factories will also significantly increase implying a tremendous amount of construction activity with its potential for causing sedimentation problems during the projection period.

SOLID WASTE LEACHATES.

Seepage from the ever increasing number of solid waste dumps and sanitary landfill sites may also pose a serious threat to water quality in the future, especially in the contamination of ground water supplies. Protection of both private and public water supplies by sealing them off from the potentially high amounts of sodium, potassium, calcium, magnesium, and organic pollutants characteristic of this leachate will be necessary to avoid contamination problems in the future. Also, some means of treating the collected leachate will be necessary.

HIGH FRESHWATER INFLOWS.

Tropical Storm Agnes was an example of the type of effects high freshwater inflows can have on the Bay's water quality. Problems are created when large amounts of various compounds are added to the water including, dissolved nitrogen, dissolved phosphorous, phosphates and nitrates. High flows can also be responsible for higher concentrations of trace metals, pesticides, and dissolved oxygen.

OUTDOOR RECREATION

The physical characteristics of the Chesapeake Bay Region make it an attractive place for such water-related recreation activities as sailing and boating, swimming, camping, and picnicking. Recent state inventories of the above activities show that the Study Area has an existing public supply of approximately 440 boat ramps, 20,200 camping sites, 26,000 picnic tables, and 2,500 acres of beach and swimming pools.

When available supply is considered in terms of demand, there presently exists a surplus of swimming and camping facilities in the Bay Region. In many cases, however, the provision of public recreation facilities has not kept pace with the burgeoning demand. The number of picnic tables and boat ramps are not sufficient to meet existing public demand. It is estimated that an additional 13.600 picnic tables and 130 boat ramps are needed. Only about one-half of one percent of the water surface area of Chesapeake Bay and its tributaries would be required to meet current boating and sailing demands. The inability to satisfactorily meet these current demands, however, is not due to an absence of water surface area, but as indicated above, to an insufficient supply of public slips and launching ramps. Generally, the current shortages in all recreational facilities are most acute in the large urban centers of the Bay Region such as Baltimore, Washington, and Richmond.

In terms of future recreation demands, the now defunct Heritage Conservation and Recreation Service (HCRS) projects the need for swimming beaches and pools to increase significantly during the next 50 years with the largest supply deficiencies projected for Baltimore, Washington, and Richmond. On the other hand, large supply surpluses are projected for the Maryland and Virginia Eastern Shore, Delaware, and Hampton Roads where sizable expanses of ocean beach exist. In similar fashion, the supply of campsites is expected to be deficient in the large metropolitan regions while in a surplus in the less populated regions and smaller urban areas. The existing deficits in picnic tables are projected to increase substantially so that by 2020 the Region will be 95,000 tables short of the total demand. Again, deficits are expected to be greatest in the largest metropolitan areas. The demand for boating ramps is expected to exceed the existing supply by almost six times by the year 2020. The only areas in the Bay Region predicted by HCRS to have a surplus of ramps through the year 2020 are the Eastern Shore of Maryland and Virginia and the tidewater portion of Virginia. Baltimore, Washington, and Richmond will again display the most critical supply deficits.

From the standpoint of the general public, Chesapeake Bay is one of the most inaccessible estuaries in the Nation. Much of the recreationally desirable land available is in competition with other forms of land development such as private homes, utility development, or military reservations. For example, in urban areas where recreation opportunities are most urgently needed, the shoreline has often been developed as major port and industrial complexes. A significant percent of the publicly-owned shoreline is held by the Federal government, primarily the military, and is unavailable for use by the general public.

Other factors interfere with the maximum recreational utilization of the Bay and its tributaries. Water quality has deteriorated in many sections of the tributaries precluding body-contact water recreation. This problem is especially severe in the urban areas where demands are the greatest. The stinging sea nettle and the closely related comb

jellies or ctenophores which reach peak abundance in the summer months also discourage water contact recreation. Other deterrents to recreation activities include the existence of extensive and often valuable wetlands and the occasionally objectionable growth of certain aquatic plants such as the Eurasian watermilfoil and water chestnut which inhibit boating and swimming.

Recreational use of the Bay and its tributaries has created problems and conflicts in itself. For example, many boaters are responsible for degrading water quality by dumping refuse overboard, discharging sewage effluent, and spilling gas and oil into the water. The result is unsightly debris, and in some cases, the closing of certain areas to both water-contact recreation and shellfish harvesting. In addition, recreational boating frequently conflicts with other aquatic activities such as swimming, fishing, commercial shipping, and private shore front property use (brought about by erosion of the shoreline from boat wakes). Finally, recreational boating has led to overcrowding of certain waterways particularly those most accessible to the large urban areas. This has created dangerous, undesirable conditions for both boaters and swimmers.

NAVIGATION

CURRENT STATUS

A total of approximately 160 million short tons of cargo was shipped on Chesapeake Bay during 1974. About 80 percent of this freight passed through the ports of Baltimore or Hampton Roads. Approximately 70 percent of the total freight traffic in these two ports is foreign in origin or destination. Baltimore is basically an importing port.

The major commodities coming into Baltimore are metallic ores and concentrates, petroleum and petroleum products, gypsum, sugar, iron and steel products, salt, and motor vehicles and motor vehicle equipment. The port is one of the Nation's leaders in the importing of automobiles and ore. The movement of bulk oil, coal, metallic ores, and grain accounted for 78 percent of the total tonnage passing through the port in 1974.

Hampton Roads, on the other hand, is an export-oriented port. Approximately 70 percent of the total freight tonnage passing through Hampton Roads in 1974 was coal and lignite to be exported. Hampton Roads leads the Nation in this category.

The port's location in relation to the coal-rich Central Appalachians gives the port a locational advantage over the other East Coast ports in the coal exporting business. Hampton Roads also conducts important trade in the exporting of corn, wheat, soybeans, tobacco leaf, and grain mill products, as well as in the importing of petroleum products, gypsum (limestone), lumber and wood products, and chemicals.

Although Baltimore and Hampton Roads are the only major international deepwater ports in the Chesapeake Bay Region, there is also a significant amount of traffic in the harbors of some of the smaller ports such as Richmond, Yorktown, Hopewell, Petersburg, and Alexandria, Virginia; Piney Point, Annapolis, Salisburg, and Cambridge, Maryland; and Washington, D.C. The major commodities shipped through these ports are petroleum and petroleum products, construction materials, fertilizers, and seafood. In addition, the Chesapeake and Delaware (C&D) Canal handles large quantities of general cargo and petroleum products.

Due to the increasing size of oceangoing vessels during the past 100 years and the economies involved in the use of these ships, repeated deepenings and widenings of Chesapeake Bay's ship channels have been necessary. The present main channel depth in Baltimore Harbor is 42 feet, although in December of 1970 Congress authorized a deepening of the channel to 50 feet. In Hampton Roads the main channel was deepened to 45 feet in 1965. The Norfolk District of the Corps has completed a report recommending that the channel be further deepened to 55 feet. With the exception of the Chesapeake and Delaware Canal, which primarily services the Port of Baltimore and the York River Entrance Channel, which handles petroleum products for a major petroleum refinery, the remaining Federal channels are 25 feet in depth or less and handle barge traffic almost exclusively.

FUTURE DEMANDS

As shown in Figures A-12 and A- 13, the bulk commodities (i.e., metallic ores, coal, petroleum, and grain) are projected to continue to dominate waterborne traffic in the port complexes of Baltimore and Hampton Roads. General cargo movements in both ports, however, are expected to increase at a very high rate over the projection period so that by 2020 the general cargo tonnage moved is expected to be higher than any other commodity category in Baltimore and behind only coal in Hampton Roads.

Waterborne commerce on the "smaller" waterways is also generally projected to increase over the projection period and is expected to continue to be dominated by bulk oil movements. Especially high rates of increases in bulk oil movements are expected for the Potomac (270 percent) and York (205 percent) Rivers. Generally speaking, the level of traffic and the rates of increase for the waterways on the Western Shore are greater than those on the Eastern Shore because of higher levels and growth rates of population and economic activity projected for the Western Shore area. The C&D Canal, while expecting moderate increases in bulk oil movements, is projected to experience an increase in general cargo movements of approximately 130 percent by 2020.

The ships carrying the bulk commodities of iron ore, coal, and petroleum products are generally the largest that ply Chesapeake Bay and its tributaries. The average iron ore vessel is in the 40,000 to 60,000 deadweight tonnage (dwt) range with 38 to 42-foot drafts. Occasionally, however, dry bulk vessels of well over 100,000 dwt bring iron ore into the Bay. The largest tankers carrying bulk oil into Chesapeake Bay are from the refineries on the Gulf Coast of the United States and range in size up to 75,000 dwt with 42-foot drafts. The average size vessel exporting coal is in the 50,000-75,000 dwt range with 38 to 46-foot drafts. However, as in the case of iron ore, vessels of over 100,000 dwt are not uncommon. The world fleet of tankers and dry bulk carriers is expected to continue to increase in average size in the future. The majority of the waterborne movements on the Eastern Shore tributaries and smaller Western Shore rivers are by barge.

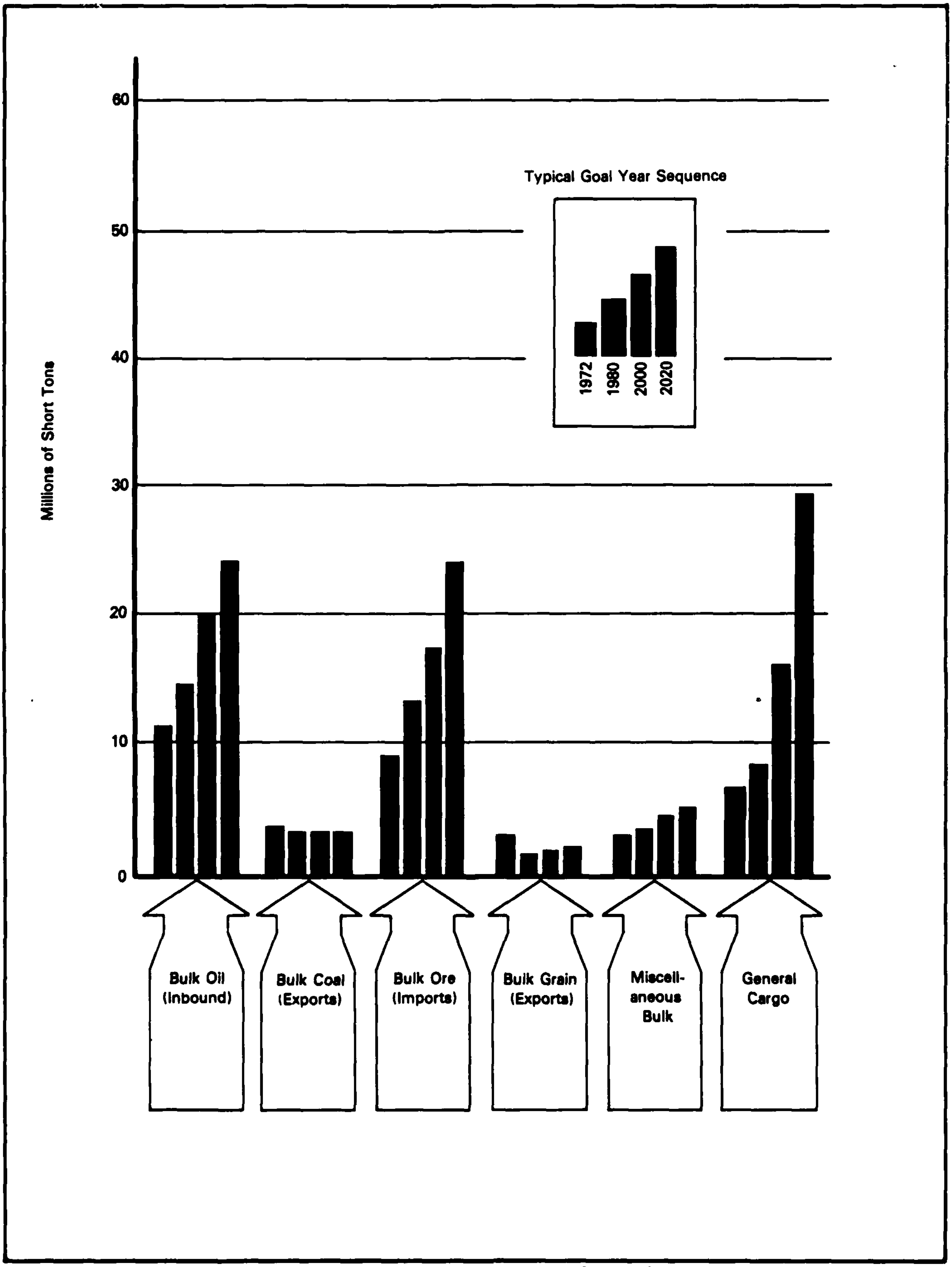


FIGURE A-12 FUTURE WATERBORNE COMMERCE - BALTIMORE HARBOR

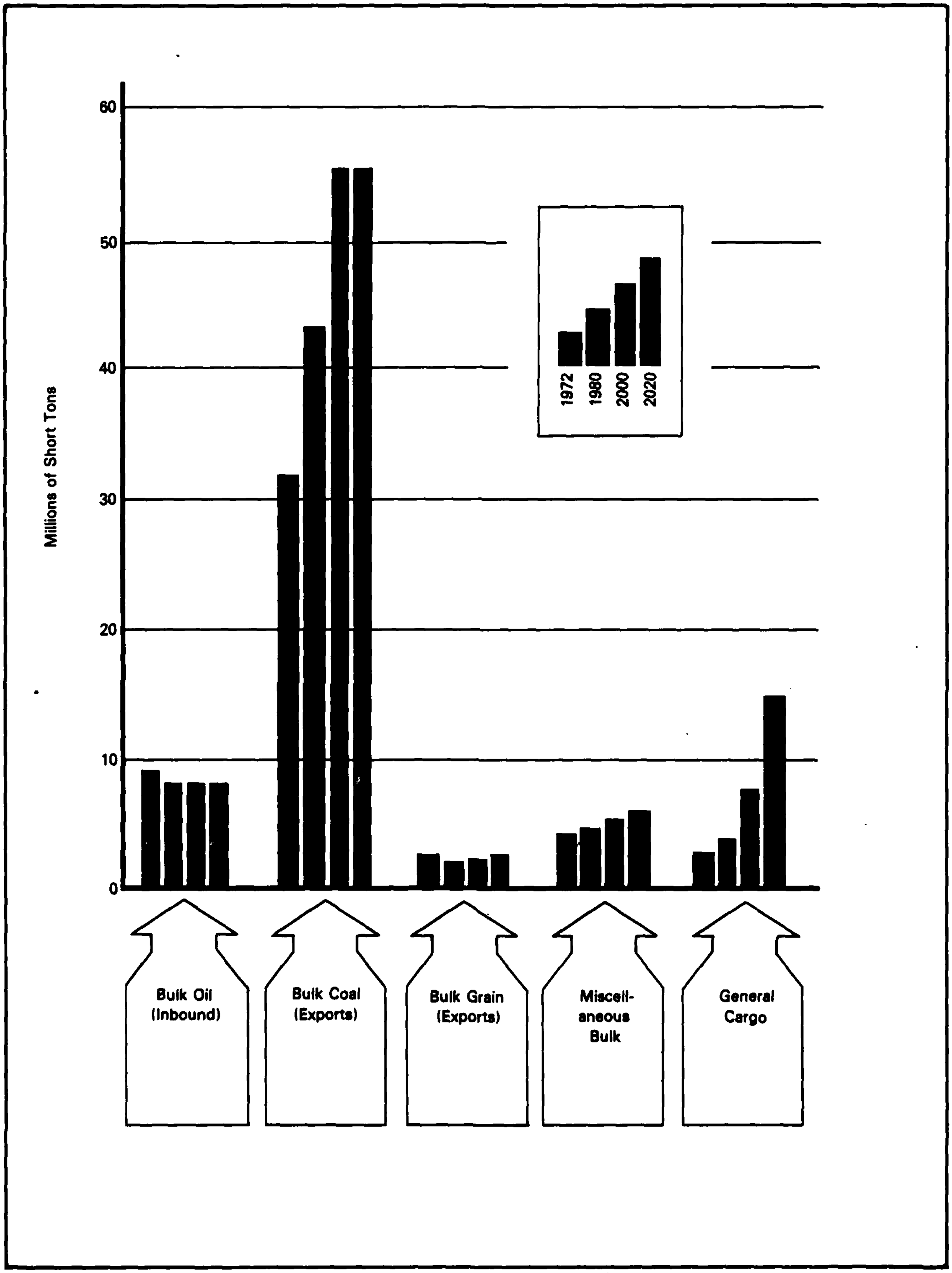


FIGURE A-13 FUTURE WATERBORNE COMMERCE - HAMPTON ROADS

PROBLEMS AND NEEDS

The following significant existing and future waterborne commerce related problems and needs were identified in the FCR.

1. A need to accommodate large bulk vessels expected to dominate the world bulk trade in petroleum, coal, and iron ore. Serious economic inefficiencies result when the larger vessels moving these commodities are unable to fully load. When these efficiency losses are severe enough to outweigh any competitive advantage an area might have for the movement a certain commodity, severe economic consequences may result. In the case of importedraw materials processed in the port area, economic losses may be serve enough to cause cutbacks in production or even plant closings resulting in the loss of jobs, income, and tax revenues to the region.

2. A need for an economically and environmentally acceptable method of dredge material disposal. In the Baltimore area, maintenance dredging by the Corps of Engineers and other public and private interests has been repeatedly delayed because of the lack of agreement on an economically and environmentally acceptable disposal site for the dredged material. While the State of Maryland has constructed a containment area for dredged material at Hart and Miller Islands near Baltimore Harbor, this disposal area will not completely satisfy long term disposal needs. The dredge material disposal situation has not been nearly as critical in the Hampton Roads area as in Baltimore due to the existence of the Craney Island Disposal Area in the middle of the Hampton Roads port complex. Total dredging requirements over a 50 year project life for a deepened Norfolk Harbor and associated channels, including new work dredging and future maintenance, would be approximately 380 million cubic yards. Disposal of this quantity is planned to be divided primarily between Craney Island Disposal Area and other approved alternative disposal sites, including ocean disposal. Dredged material disposal in the smaller waterways and harbors is normally not a problem.

3. A need to alleviate potential congestion problems in port, channel, and anchorage areas. As vessel traffic on Chesapeake Bay increases in the future, congestion will also probably increase. Increased congestion means the potential for accidents and the resultant discharge of hazardous substances into the water may also increase. The traffic associated with these facilities would significantly increase the level of potentially hazardous substances moving on the Bay.

4. A need to minimize the potential conflicts between commercial and recreational users of the Bay's waters and beaches. Recreational fishing and boating can be disrupted by the wakes from passing ships. In addition, large areas of the Bay and its tributaries are precluded from recreational uses because of their use as anchorages, ship channels, or dredge disposal areas by commercial navigation interests and/or the military. On the other hand, large commercial and military vessels must be constantly on the alert for the smaller recreational vessels to avoid collisions or swampings.

5. A need to minimize the erosion damages from waves caused by commercial and military vessels. In some areas of the Bay Region (e.g., the area around the Elk River entrance to the C&D Canal) the wave action caused by passing ships is a major cause of shoreline erosion.

AD-A161 475 CHESAPEAKE BAY STUDY SUPPLEMENT A PROBLEM IDENTIFICATION SUPPLEMENT B PUB..(U) CORPS OF ENGINEERS BALTIMORE MD BALTIMORE DISTRICT SEP 84 2/5

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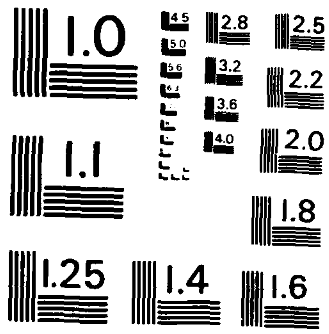
1.0
4.5
5.0
5.6
2.8
2.5
3.2
2.2
3.6
4.0
2.0
1.1
1.8
1.25
1.4
1.6

6. A need to provide additional lands to accommodate expanding port facilities. The development of a major port is dependent on the concurrent development of land-based port-related facilities. However, the development of shoreline land for terminal facilities may in some cases conflict with existing wetlands or proposed recreational use of the same land. In addition, port-related facilities, because of their location, may be subject to tidal flooding and shoreline erosion.

TIDAL FLOODING

THE TIDAL FLOODING PROBLEM

Since man first settled on the shoreline of Chesapeake Bay, he has been subject to periodic tidal flooding which has resulted in immeasurable human suffering and millions of dollars of property damage. Serious tidal flooding in the Chesapeake Bay Region is caused by either hurricanes or "northeasters." Hurricanes which reach the Middle Atlantic States are usually formed either in the Cape Verde Region or the Western Caribbean Sea and move westerly and northeasterly direction in the vicinity of the East Coast of the United States.

As a hurricane progresses over the open water of the ocean, a tidal surge is built up, not only by the force of the wind and the forward movement of the storm wind field, but also by differences in atmospheric pressure accompanying the storm. The actual height reached by a hurricane tidal surge and the consequent damages incurred depend on many factors including shoreline configuration, bottom slope, difference in atmospheric pressure and wind speed. Generally, the tidal surge is increased as the storm approaches land because of both the decreasing depth of the ocean and the contours of the coastline. An additional rise usually occurs when the tidal surge invades a bay or estuary as hurricane winds drive waters to higher levels in the more shallow waters. Tidal surges are greater and the tidal flooding more severe in coastal communities which lie to the right of the storm path due to the counterclockwise spiraling of the hurricane winds and the forward movement of the storm.

"Northeaster" is a term given to a high intensity storm which almost invariably develops near the Atlantic Coast. These storms form so rapidly that an apparently harmless weather situation may be transformed into a severe storm in as little as 6 hours. Most northeasters occur in the winter months when the temperature contrasts between the continental and maritime air masses are the greatest. The East Coast of the United States has a comparatively high incidence of this type of storm, with the area near Norfolk, Virginia, being one of the centers of highest frequency.

In the course of recorded history, the Chesapeake Bay Region has been subjected to about 100 storms that have caused damaging tidal flooding. The accounts of most of the storms that occurred prior to 1900 are very brief and are usually found only in early newspaper articles and private journals. The elevation and the area inundated by these early tidal floods was seldom accurately documented and it was not until the early part of the 20th century that a program to maintain continuous records of tidal elevations was initiated. The damages and loss of life suffered during these early floods is also not well documented.

Shown in Table A-16 are the recorded tidal elevations at several locations for the most severe floods that have occurred in this century. It should be noted that the relative severity of flooding varies around the Bay since it is a function of changes in storm paths and variances in climatological and astronomical tide conditions.

TABLE A-16
RECENT CHESAPEAKE BAY STORMS

Storm	Tidal Elevations (Feet Above Mean Sea Level)			
	Norfolk	Mid-Bay	Washington	Baltimore
August 1933	8.0	7.3	9.6	8.2
September 1936	7.5	-	3.0	2.3
October 1954 "Hazel"	3.3	4.8	7.3	6.0
August 1966 "Connie"	4.4	4.6	5.2	6.9
August 1955 "Diane"	4.4	4.5	5.6	5.0
April 1956 "Northeaster"	6.5	2.8	4.0	3.3
March 1962 "Northeaster"	7.4	6.0	-	4.7

The hurricane of 23 August 1933 was the most destructive ever recorded in the Bay Region. The hurrican center entered the mainland near Cape Hatteras, passed slightly west of Norfolk, Virginia, and continued in a northerly direction passing just east of Washington, D.C. It moved at or near the critical speed for producing the maximum surge, and its time of arrival coincided with the astronomical high tide as it proceeded upstream. The results were tides ranging from 8.0 feet above mean sea level (msl) at Norfolk to as high as 9.6 feet (msl) at Washington, D.C. In addition to flooding damage, the high winds associated with this storm generated very destructive waves which caused extensive shoreline erosion.

Shown in Table A-17 is an estimate of the damages that were caused by the four most damaging storms that have passed through the Bay Region. The estimates reflect the actual physical damages that occurred, updated to reflect 1983 price levels. These figures do not reflect the damages that would result from a recurrence of these storms under today's conditions due to differences in development in the flood plain.

TABLE A-17
TIDAL FLOOD DAMAGES

Location	Storms and Damages in Millions of Dollars			
	August	Oct 1954 "Hazel"	Aug 1955 "Connie"	Mar 1962
Baltimore Metro Area	$43.5	$12.8	21.3	*
Washington Metro Area	22.2	8.9	0.6	*
Maryland Tidewater Area	21.1	16.8	3.3	*
Norfolk Metro Area	15.7	*	*	8.9
Virginia Tidewater Area	*	*	*	45.7

*Negligible

EXISTING FLOOD PROBLEM AREAS

Existing flood problem areas were initially identified by considering the degree of tidal flooding that would be experienced by those communities located along the shoreline of the Bay and its tributaries. The analysis was limited to communities or urbanized areas since residential, commercial, and industrial development would suffer the greatest monetary losses as a result of a tidal flood.

The initial step in the analysis was to identify all Bay communities having a population of 1,000 or greater that are located either in total or in part within the "Standard Project Tidal Flood Plain." The Standard Project Tidal Flood (SPTF) is defined as the largest tidal flood that is likely to occur under the most severe combination of meteorological and hydrological conditions that are considered reasonably characteristic of the geographic region. The Corps of Engineers in cooperation with the U.S. Weather Bureau determined that for the Chesapeake Bay Region the SPTF would average approximately 13 feet above mean sea level (msl). The above figure is a static or standing water surface elevation which would occur in conjunction with an astronomical high tide and does not include the effects of waves. Waves characteristic of a hurricane that would produce a tidal surge of 13 feet above msl, would be approximately 5 feet in height. Based on the above combination of tidal surge and wave action, the SPTF would inundate areas up to approximately 18 feet above msl. However, for ease in delineating the flood area on the best available topography, an elevation of 20 feet above msl was assumed for the SPTF elevation. While an elevation of 20 feet above msl is considered to be conservative, it was considered appropriate for the initial screening of possible floodprone communities.

The next step in the flooding analysis was to identify those communities that should be classified as "floodprone." In order for a community to be designated as floodprone, at least 50 acres of land that were developed for intensive use had to be inundated by the SPTF. Intensive land use was defined as residential (four dwelling units/acre or greater), commercial (including institutional), or industrial development. The 59 Bay Region communities identified as floodprone are shown on Table A-18. Approximately 82,000 acres of land in these communities were found to be located in the SPTF flood plain.

FUTURE TIDAL FLOOD PROBLEM AREAS

The criteria used for designating an area as future floodprone was that 50 acres or more of land proposed for intensive land use fall within the Standard Project Tidal Flood Plain. Areas were considered to be "critically" floodprone if 25 acres or more of land proposed for intensive land use were within the 100-year flood plain. The additional flood plain areas found to be critically floodprone are shown on Table A-19. Based on a comparison of the existing and future acreage, an additional 58,432 acres of land is proposed for intensive development within the Standard Project Tidal Flood Plain and 19,461 acres of land within the 100-year flood plain.

TABLE A-18
FLOODPRONE COMMUNITIES

State of Maryland

Anne Arundel County
* Arundel on the Bay
*Avalon Shores (Shady Side, Curtis Pt. to Horseshoe Pt. and West Shady Side)
Broadwater
Columbia Beach
*Deale
Eastport
Franklin Manor on the Bay and Cape Anne
Galesville
Rose Haven

*Baltimore City

Baltimore County
Back River Neck
*Dundalk (Including Sparrows Pt.)
*Middle River Neck
*Patapsco River Neck

Calvert County
Cove Point
North Beach on the Bay
Solomons Island

Caroline County
Choptank
*Denton
Federalsburg

Cecil County
Elkton
Northeast

Charles County
Cobb Island

Dorchester County
*Cambridge

State of Maryland (Cont'd)

Harford County
Havre de Grace

Kent County
*Rock Hall

Queen Anne's County
Dominion
*Grasonville
Stevensville

St. Mary's County
Colton
*Piney Point
St. Clement Shores
St. George Island

Somerset County
*Crisfield
*Smith Island

Talbot County
Easton
Oxford
*St. Michaels
*Tilghman Island

Wicomico County
Bivalve
Nanticoke
*Salisbury

Worcester County
*Pocomoke City
*Snow Hill

TABLE A-18 (cont'd)
FLOODPRONE COMMUNITIES

Commonwealth of Virginia

Independent Cities
*Fredericksburg
*Hampton
*Norfolk
*Portsmouth
*Virginia Beach
*Chesapeake

Accomack County
Onancock
Saxis
*Tangier Island

King George County
*Dahlgren

King William County
*West Point

Northampton County
*Cape Charles

Westmoreland County
*Colonial Beach

York County
*Poquoson

*Washington, D.C.

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*Indicates "critically" floodprone communities.

TABLE A-19
CRITICAL FUTURE FLOODPRONE AREAS

State of Maryland

Anne Arundel County
Arundel on the Bay

Baltimore County
Dundalk (Including Sparrows Point)

Cecil County
Elkton
Northeast

Kent County
Rock Hall

Queen Anne's County
Grasonville
Stevensville

Somerset County
Smith Island

State of Maryland (cont'd)

Talbot County
St. Michaels

Wicomico County
Salisbury

Worcester County
Pocomoke City

Commonwealth of Virginia

Independent Cities
Hampton
Norfolk
Virginia Beach
Chesapeake

York County
Poquoson

SHORELINE EROSION

THE SHORELINE EROSION PROCESS

The shorelands of Chesapeake Bay are composed of three physiographic elements--fastland, shore, and nearshore. The fastland is that area landward of normal water levels. The shore is the zone of beaches and wetlands which serve as a buffer between the water body and the fastland. Lastly, the nearshore extends waterward from the mean low water level to the 12-foot depth contour. In the Chesapeake Bay proper, the nearshore is generally comprised of a shallow water belt more than 1,000 feet wide before the 6-foot mean low water depth contour is encountered. From the 6-foot contour outward, the depth increases at a more rapid rate.

While the causes of shoreline erosion are complex and not completely understood, the primary processes responsible for erosion are wave action, tidal currents, and groundwater activity. Waves generated by wind are the cause of most of the shoreline erosion in the Bay Region. The amount of wave energy which reaches the shoreline is dependent on the slope of the nearshore. A shallow nearshore will dissipate more wave energy than a deep nearshore. In addition, less wave energy is received by a shoreline if there is a shoal, tidal flat, or aquatic vegetation immediately offshore. Similarly, a wide beach is better than a narrow beach for wave dissipation. Conversely, where the shoreline has none of the above natural features and wave action is strong, undercutting of the ground landward of the beach will cause sliding, slumping, and resultant loss of fastland.

Waves associated with hurricanes or other large storms can also be extremely damaging. These storms can generate very large, steep wind waves which can remove considerable material from the shore zone and carry it offshore. Strong winds of these storms often raise water levels and expose to wave attack lands of higher elevation that are not ordinarily vulnerable.

Erosion problems caused by tidal currents are usually most severe in constricted areas such as inlets to lagoons and bays or at entrances to harbors. In addition to creating currents which cause erosion, the tides constantly change the level at which waves attack the beach, thereby aggravating the problem.

Another process which contributes to the erosion of the shoreline is the seepage of ground water through the fastland and into the exposed shore zone. Water percolates downward through porous soils and flows out through exposed bank faces often causing an erosion of bank materials. This process is accelerated where man has removed the natural cover on the land adjacent to the banks thus increasing the amount of rainfall seeping into the ground.

To a much lesser degree, three other factors contribute to the shoreline erosion problem in Chesapeake Bay. First, the long term rise of sea level has resulted in the inundation or loss of land to the Bay. An average rise of 0.01 feet per year has been recorded in the lower Chesapeake Bay. At Fort McHenry in Baltimore, Maryland, the National Ocean Survey tide gage indicated a 0.6 foot rise in mean sea level between 1902 and 1962. These seemingly insignificant rates of increase can, over the years, inundate significant land area particularly where shorelands have very gentle slopes. Second, rainfall runoff can cause or contribute significantly to shoreline erosion, particularly in areas where the adjacent shoreline is rolling and broken and soils are made up of easily erodible materials. Lastly, in some areas of the Bay, especially around busy harbors and waterways such as the Chesapeake and Delaware Canal, the wakes from passing ships are a significant erosive force.

EXISTING EROSION PROBLEMS

The natural processes discussed in the preceding paragraphs have claimed thousands of acres of land around Chesapeake Bay and its tributaries. Over the last 100 years alone, approximately 45,000 acres of land have been lost due to erosion. The most significant impact of the loss of this amount of land has been on the landowners who have witnessed the loss of both valuable shoreland and improvements that may have been constructed too close to the shoreline. Attempts to try to arrest the rate of erosion through either poorly designed or constructed protective measures have further frustrated property owners when their efforts proved futile. In many cases, man has accelerated the rate of erosion by eliminating natural protective devices such as vegetative cover that inhibit erosion.

Sediment, the product of erosion, has also had significant impacts on both the natural environment and man's use of the resource. Sediment from shoreline erosion may eventually be deposited in either natural or man-made navigation channels requiring maintenance dredging and the problems normally associated with the disposal of the dredged material. In addition, sediment also has a considerable impact on water quality and the biota of the Bay. The sediment can cover productive oyster beds and valuable aquatic plants. The reduced light penetration into turbid waters can also be very detrimental to aquatic life.

In order to define those areas or reaches of tidal shoreline along the Bay and its tributaries that are suffering "critical" losses of land, an inventory of historical erosion rates and the adjacent land use was compiled. Using these erosion rates together with the land use information, reaches were designated as having critical erosion problems if they met or exceeded the following criteria:

1. The erosion rate was equal to or greater than 3 feet per year regardless of adjacent land use.

2. The erosion rate was equal to or greater than 2 feet per year and the adjacent land use was intensive, i.e., residential, commercial, or industrial.

Approximately 402 miles of shoreline were identified as existing "criteria erosion reaches." Table 11-1 of Appendix 11 of the Future Conditions Report lists each critical reach by county and state, the land use in the reach, each length, erosion rate and an evaluation of existing structural shoreline protection measures within the reach. Table A-20 lists the amount of critically eroding shoreline by county for Maryland and Virginia.

FUTURE EROSION PROBLEMS

The method employed to delineate future problem areas is essentially the same as that used to define the existing critical areas. It was assumed that the historical erosion rates were reflective of future erosion rates in the same reaches. It was further assumed that future land use adjacent to the shoreline would develop as shown in the latest regional, county, or municipal land use planning documents. Given the historical erosion rates and projected future land use adjacent to the shoreline, the entire Bay shoreline was surveyed to determine if any future development was proposed in areas subject to significant shoreline erosion.

It was determined that an additional 44.4 miles of Bay shoreline has the potential to become a serious problem. This is in addition to the over 400 miles of shoreline that is currently classified as critical based on existing development.

FISH AND WILDLIFE

The fish and wildlife of the Chesapeake Bay Region contribute in many ways to making the Bay what it is today, both in terms of commercial markets and in terms of recreational enjoyment. Increasingly, people are turning to the out-of-doors for use of their leisure time, and fish and wildlife contribute both directly and indirectly to the value of the outdoor experience. Sport hunting and fishing, for example, are major activities of outdoor enthusiasts, as are such activities as birdwatching and nature photography. In addition, commercial interests rely on fish and wildlife resources as an important source of income and employment.

The average commercial landings of finfish in Chesapeake Bay during the period 1966 to 1970 totaled 409 million pounds worth $31.2 million. Finfish consist of both edible and industrial species. The latter include mainly menhaden and alewives. Menhaden alone accounted for approximately 88 percent of all finfish landings by weight in 1970. Edible finfish types include striped bass, weakfish, shad, catfish, bluefish, spot, white perch, croaker, flounder, and herring.

TABLE A-20
LENGTH OF CRITICALLY ERODING SHORELINE

County/City	Length of Critical Shoreline Miles
MARYLAND	
Anne Arundel	32.4
Baltimore	5.0
Calvert	9.6
Cecil	9.3
Charles	8.2
Dorchester	61.6
Harford	5.7
Kent	9.9
Queen Anne's	24.0
Somerset	23.0
St. Mary's	20.6
Talbot	27.1
Wicomico	23.1
Subtotal	259.5
VIRGINIA	
Accomack	24.2
Essex	7.6
Glouchester	7.0
Hampton	14.2
Isle of Wight	7.7
Lancaster	8.4
Mathews	9.7
Middlesex	7.7
Northampton	10.4
Northumberland	18.3
Richmond	3.5
Surry	3.8
Virginia Beach	6.0
Westmoreland	10.4
York	4.0
Subtotal	142.9
TOTAL	402.4

Shellfish, which are commonly harvested commercially, include crabs, oysters, soft clams, and hard clams. Shellfish harvests averaged 88 million pounds worth $23 million between 1966 and 1970. That shellfish represent the big money crop in Chesapeake Bay is evidenced by their 78 percent share of total harvest value while comprising only 24 percent of the commercial harvest by weight.

In addition to the commercial fishing effort, catches of finfish and shellfish by recreationists make up the balance of the total fishery harvest. Several species of fish are particularly sought by the recreational fisherman, including in order of pounds landed in 1970: spot, striped bass, white perch, weakfish, shad, croaker, flounder, yellow perch, catfish, and bluefish. It is estimated that all of these but striped bass, flounder, and catfish actually exceed the commercial catch, demonstrating the importance of recreational fishing in the Bay. Shellfish are also taken by a considerable number of people on a recreational basis. It has been estimated that blue crabs are sought by as many people as are game fish, and that the recreational quantity caught may equal the entire commercial harvest.

The fishermen responsible for catching the finfish and shellfish resources of the Bay constitute the harvesting sector of the commercial fishing industry. Employment in the harvesting sector was 17,400 full and part-time fishermen in 1973. This figure has remained relatively constant since 1955, ranging between 16,000 and 20,000 each year. In addition, 7,100 persons were employed in wholesaling and in processing plants in 1973 in Maryland and Virginia.

Wildlife that are trapped for commercial purposes in the Study Area attained a value of $1.8 million in the 1971-1972 season (including the meat value of animals such as muskrat). Fur bearing species commonly trapped in the Study Area are beaver, gray fox, red fox, mink, muskrat, opossum, otter, raccoon, skunk, weasel, and bobcat. The muskrat is of primary economic importance since it provides approximately 69 percent of the total income of Bay trappers.

Hunting in the upland forests, farms, wetlands, and open water areas of the Study Area is a widely practiced form of recreation. Animals such as deer, rabbit, squirrel, woodchuck, raccoon, and opossum, and game birds such as turkey, quail, and dove are hunted in the uplands. In the open water and wetland areas, waterfowl, such as ducks, geese, and other birds such as rails and woodcock, are the most significant sources of hunting experience.

The wetlands and uplands of the Study Area are also inhabited by plants and animals which are enjoyed strictly for their presence as part of the outdoor experience. Wild untraveled areas provide a source of recreation to large numbers of people who enjoy birdwatching, nature walking, and photography. It is estimated that the number of people in the U.S. in 1970 that participated in these non-consumptive outdoor activities was about 9 percent higher than the number of people fishing and hunting.

Projections of future demands for finfish and shellfish resources in the Bay show the relation between catch and the estimated maximum harvest that can be sustained over time without causing damage to the standing stock population. Sustained harvesting beyond this "Maximum Sustainable Yield" (MSY) results in an eventual decline in the species population due to overharvesting. Results of the analysis conducted as part of the Chesapeake Bay Future Conditions Report are presented in Table A-21.

TABLE A-21
PROJECTED PERIOD OF EXCEEDENCE OF MAXIMUM SUSTAINABLE YIELD (MSY) FOR THE MAJOR COMMERCIAL AND SPORTS SPECIES

Species	1,000 lbs	Percent MSY	Prior to 1980	1980-2000	2000-2020
Blue Crab	61,373	94		X	
Oysters	23,740	79			X
Softshell Clams	5,412	90			X
Menhaden	449,790	90			X
Alewife	21,110	84			X
Spot	14,193	96	X		
Striped Bass	11,159	96		X	
White Perch	7,225	64		X	
Shad	7,120	93		X	
Weakfish (Sea Trout)	5,174	81		X	
Flounder	4,575	89		X	
Catfish	2,440	54			
Scup	2,281	35			
Sea Bass	2,084	42			
American Eel	1,692	99		X	
Yellow Perch	1,511	44			

NOTE: Represents commercial plus recreational catch except for blue crabs, oysters, and soft clams.

All of the commercially and recreationally important species, with four exceptions, are projected to experience commercial and recreational pressures in excess of their MSY's prior to 2020. MSY is expected to be exceeded for half of the species by the year 2000. With the exception of the blue crab and American eel, recreation catches are the major reason for MSY exceedence. Oysters, soft clams, menhaden, and alewife are primarily commercial species which explains, at least in part, the later period for MSY exceedence. Catfish, scup, sea bass, and yellow perch populations are capable of withstanding significant increases in fishing intensity, without adverse effect. All four species are presently underutilized. As the total harvest of a species approaches the MSY, it was assumed that recreational catches will have precedence over those in the commercial sector. As a result, commercial catches of many recreationally important species are actually projected to decline over the projection period.

Manpower in the harvesting sector of the commercial fisheries industries is anticipated to decline along with the projections of reduced commercial harvests. Even with the expanded commercial harvest projected for oysters, the existing number of fishermen working the Bay is expected to remain adequate through 2020. Employment in the processing sector, projected as a function of commercial catches of alewife, menhaden, oyster, blue crab, and clams, is also expected to remain essentially constant or at least at current levels through 2020.

Future hunting effort for big game and waterfowl was seen primarily as a function of the amount of land available as quality habitat for wildlife and the degree of access by the public to it. Hunting effort is projected to increase by 70 percent for waterfowl and by

141 percent for big game by 2020. Small game hunting is projected to decline over the study period. Based on the hunting demand analysis, land access requirements for hunting should increase by 7, 35, and 61 percent by 1980, 2000, and 2020, respectively, over the amount available in 1970.

Non-consumptive wildlife utilization in terms of recreation days in the Chesapeake Bay Region (excluding nature walking) is projected to increase at a slightly higher rate than the population. Nature walking is expected to increase at a rate equal to population growth. A total increase in activity of 34.6 million recreation days is projected to occur by the year 2020. As in the hunting analysis, the factors most affecting the provision of a quality non-consumptive recreational experience are the availability of suitable habitats for wildlife and access by the public to it. Compared with the 814,000 acres of public land presently available, about 1.9 million acres of public land will be required by 2020 for non-consumptive outdoor activity.

There are many activities associated with the fish and wildlife resources of Chesapeake Bay which either harm the resource itself or hinder its utilization. Conflicts have arisen between the need for more intensive use of the existing land and water resources and the need for these same resources to maintain fish and wildlife populations. This is especially true in the wetland areas where dredge-and-fill operations have been performed to develop industrial and agricultural lands, and to provide for second home development and marinas. Water quality problems, which have also become more pronounced with increased economic development and population growth, have serious implications for fish and wildlife. Almost every activity of man in the Chesapeake Bay Region produces a waste product that often is most conveniently dumped in a nearby river or stream. These tributaries invariably flow to the Bay.

Conflicts and problems also arise within the internal workings of the various elements of the fish and wildlife management structure. This is because management of the wildlife, fisheries, and shellfish resources of the Chesapeake Bay and its tributaries is the responsibility of several organizations including the Federal Government, the States of Maryland, Delaware, and Virginia, and the Potomac River Fisheries Commission. The inconsistencies in laws promulgated by these organizations create conflicts in the management practices and utilization of the resource. The most notable management conflicts in relation to fish and wildlife occur in the areas of migratory birds, wintering crabs, and anadromous fish.

Fluctuations that occur in finfish and shellfish populations are a problem influencing both the resource itself and the volume of harvest by man. Historically, the populations of many species have varied cyclically over periods of years, due to complex biological factors such as predator-prey relationships; physical and chemical factors; and man induced factors such as pollution or level of exploitation of the resource. In this regard, special concern has been voiced over the possible habitat destruction that may occur in the Bay due to increased consumptive losses from the Bay's sources of freshwater inflow. Recent experience with the intrusion of MSX and the devastating impacts on the oyster serve as an indicator of how changes in freshwater inflow change salinity intrusion and in turn may permit the extension of undesirable species. The interrelationships and subtle influences of the many causative factors involved in population fluctuations are far from being totally understood.

Future growth in population in the Study Area will require much in the way of additional land and water habitat for fish and wildlife if a quality outdoor experience is to be maintained for future generations of hunters and others who enjoy the outdoors. A decision must be made, however, as to whether it is in the best overall interest to grant the public increased access to prime land and water habitats. Achieving this increased access would require new public land acquisition and/or arrangements with private land owners.

ELECTRIC POWER

POWER REQUIREMENTS AND GENERATING FACILITIES

In studying the electric power resources of Chesapeake Bay, a geographic area encompassing the electric utilities serving the Bay Region was defined. This area, the Chesapeake Bay Market Area, is served by a total of 74 utilities (see Figure A-14). The utilities are of varied ownerships: private corporations, municipalities, consumer cooperatives, and the Federal government. Investor-owned utilities provide 90 percent of the energy requirements for the Market and are responsible for 95 percent of the electricity generated. The municipally-owned utilities are small and derive most or all of their energy from the large investor-owned utilities with only minimal generation of their own. The cooperatively-owned utilities for the most part purchase all their energy from other utilities. Where they do have generating capacity, it is in small plants with relatively little output. There is only one Federal utility in the Market Area, the Kerr and Philpott Project, which is operated by the U.S. Army Corps of Engineers.

The utilities within the Chesapeake Market Area operate as bulk power suppliers, wholesale generators, or wholesale purchasers. The bulk power suppliers operate substantially all of the generating and transmission facilities in the Chesapeake Market. Besides furnishing their own franchise requirements, they sell large amounts of energy to other utilities, mainly municipalities and cooperatives. Wholesale generators operate a generating plant and sometimes associated transmission lines and sell the entire output to other utilities under long-term contracts. Wholesale purchasers are the most numerous of the utilities in the Chesapeake Market. They buy energy at bulk rates from bulk power suppliers or wholesale generators and resell it to their own retail customers.

MARKET SECTORS

In recognition of the geographical and technical characteristics of the Market Area utilities, the Market was divided into three sectors: Chesapeake West, Chesapeake East, and Chesapeake South. Chesapeake West includes the Baltimore-Washington corridor of the Pennsylvania-New Jersey-Maryland power interconnection (PJM Pool); Chesapeake East takes in the Delmarva Peninsula portion of the PJM Pool; and Chesapeake South covers the Virginia portion of the Virginia-North Carolina-South Carolina power interconnection (VACAR Pool). Figure A-15 shows the relative energy requirements in each market sector as of 1972.

Figure A-16 shows the "energy account" for the Chesapeake Bay Market Area in 1972. This energy account is a flowchart showing the source and disposition of energy for each of the three Sectors.

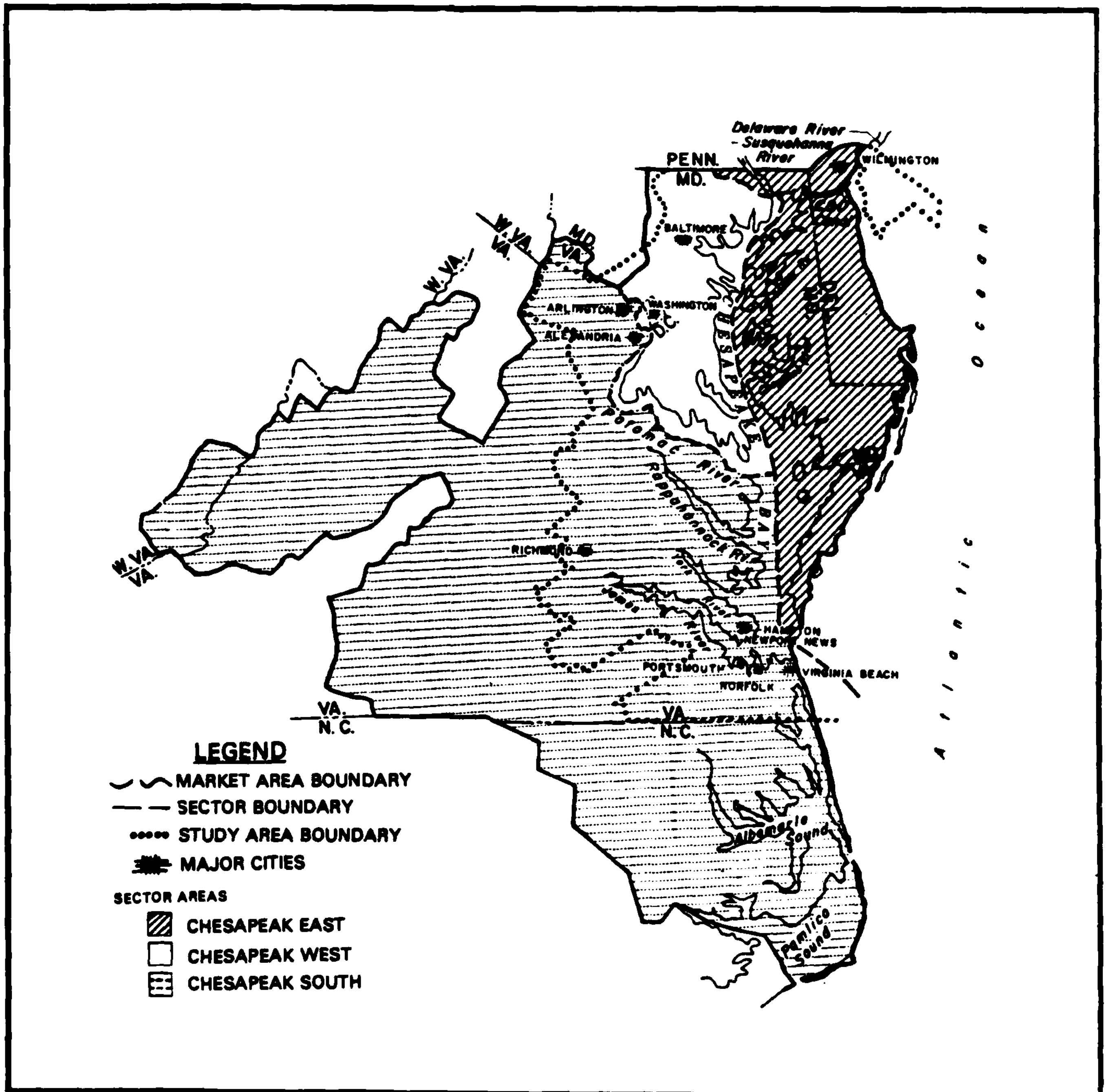

FIGURE A-14 CHESAPEAKE BAY ELECTRIC UTILITY MARKET SECTOR AND STUDY AREAS

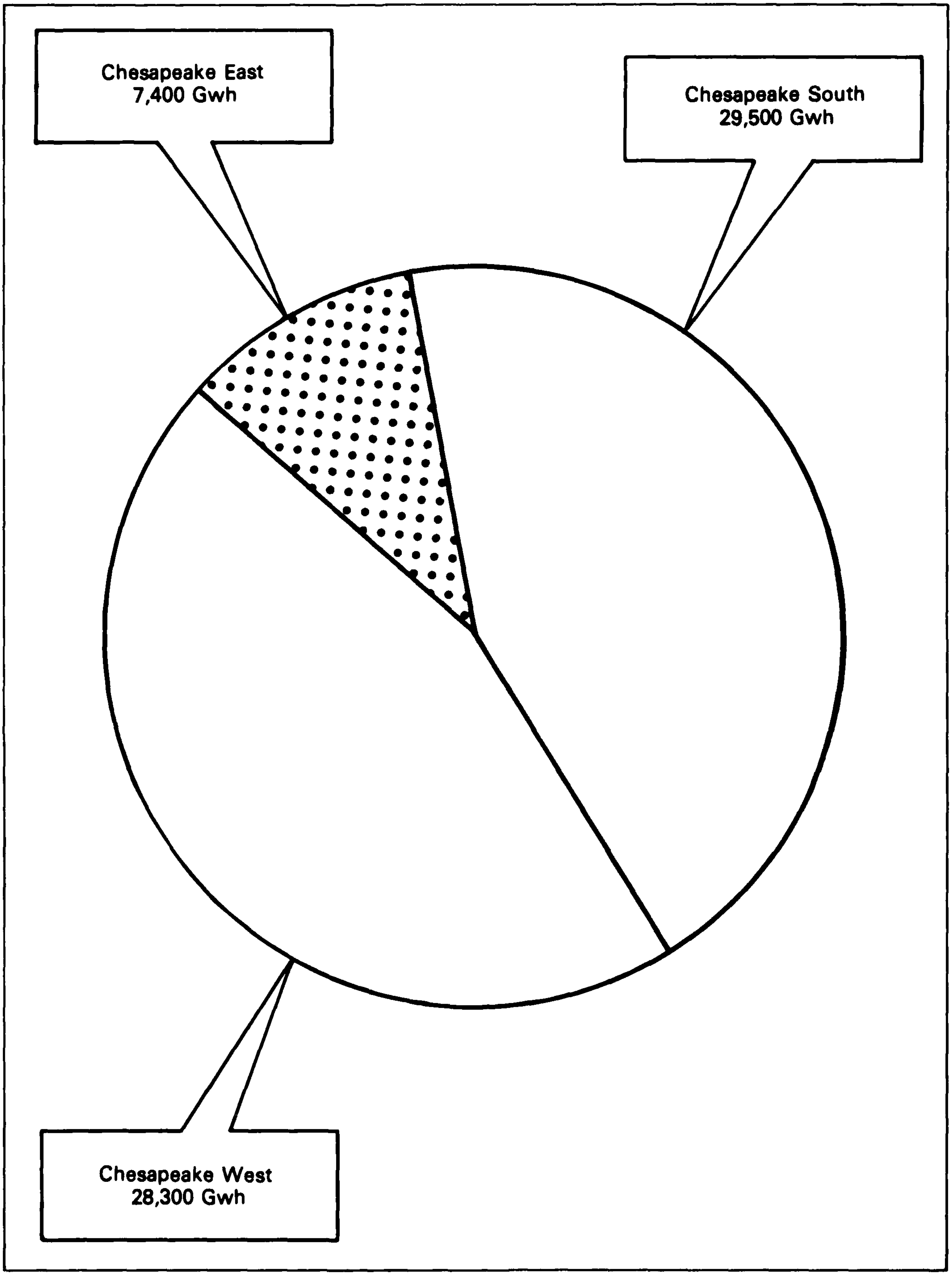

FIGURE A-15 ENERGY REQUIREMENTS IN CHESAPEAKE BAY AREA MARKET SECTORS, 1972

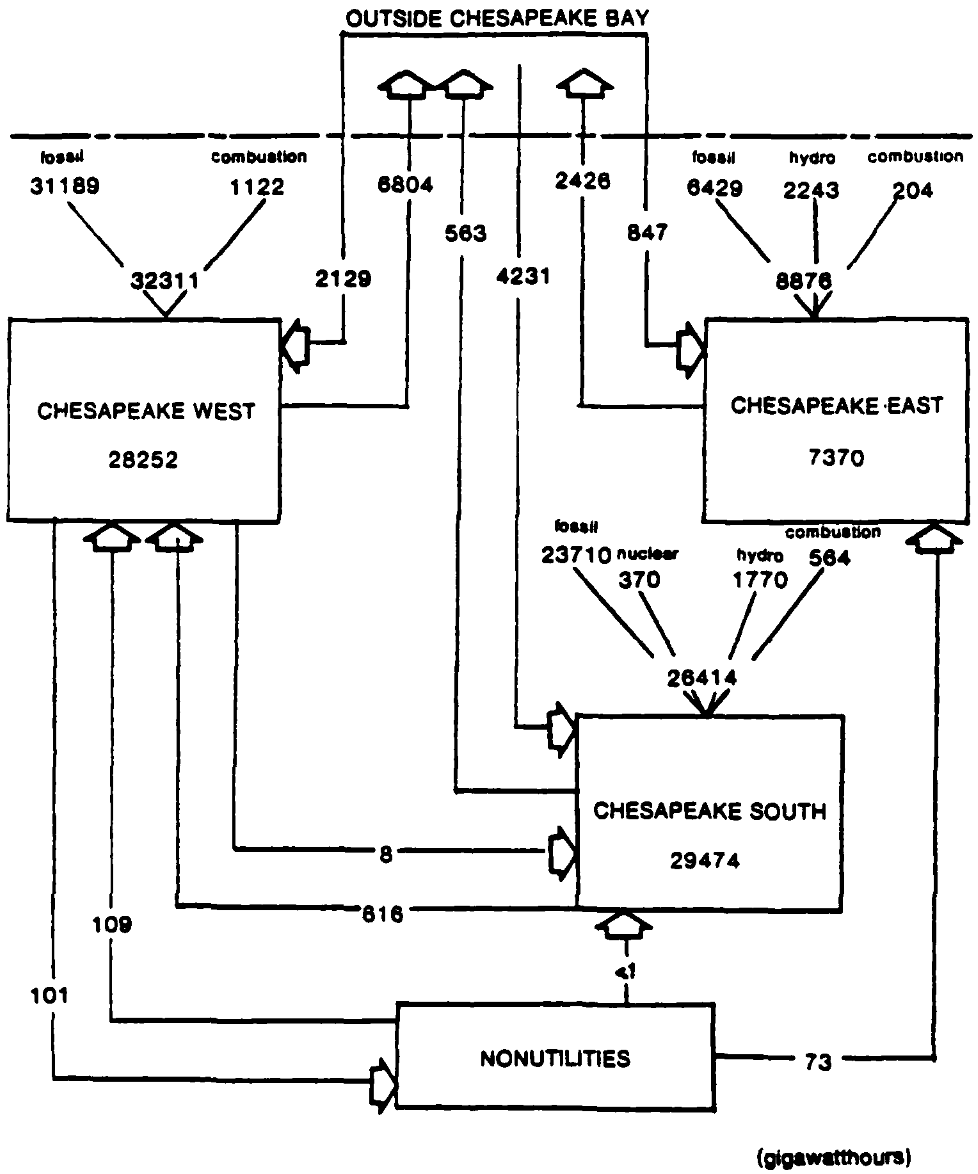

FIGURE A-16 ENERGY ACCOUNT FOR CHESAPEAKE BAY MARKET AREA 1972

As shown on Table A-22, approximately 91 percent of the electric power produced in the Market Area was generated by fossil steam generation plants using coal, oil, or gas as fuels. The remainder of the electricity was produced by hydropower, nuclear or combustion facilities.

TABLE A-22
PERCENT CONTRIBUTION OF FUEL TYPES
TO TOTAL ELECTRIC GENERATION - 1972

	Fossil Steam Generation					
Sector	Coal	Oil	Gas	Hydro-power	Nuclear	Combustion
Chesapeake East	29	42	2	25	-	2
Chesapeake West	48	48	-	-	-	4
Chesapeake South	26	64	-	7	1	2
TOTAL MARKET AREA	36	54	1	6	1	3

COOLING WATER REQUIREMENTS

The production of electricity by the steam cycle involves the condensation of exhaust steam back to water and the consequent release of waste heat. Nearly all existing steam-electric plants use cooling water in the process of removing the waste heat from the power generating system. The heated cooling water, having accomplished its task, can be pumped into cooling towers or returned to its source, in this case, usually Chesapeake Bay or one of its tributaries.

All but three of the steam plants in the Chesapeake Market employ "once-through" cooling (i.e., as opposed to re-cycled cooling waters). The rate of flow of the cooling water through the plant and the rise in cooling water temperature differ among plants because of variations in design and operating conditions of the facility. In general, the temperature rise of cooling water in the plant is usually in the range of 10° to 25° F (6° C to 14° C). Maximum allowable temperature increases are established by Federal and state regulations. Large nuclear steam-electric plants, however, require approximately 50 percent more cooling water for a given temperature rise than a fossil plant of equal size. This has a great deal of significance since nuclear plants are projected to supply a much larger portion of the Region's energy in the future.

EXISTING PROBLEMS AND CONFLICTS

In addition to the conflicts of use which may arise in the Study Area as a result of multiple demands for water or land, the resolution of certain social issues currently affecting the utility industry could also influence use of water and land for the generation of electric power in the Study Area.

Prevailing controversies concerning the generation of electric power and its impact on the environment include such issues as esthetics, air pollution, water quality, impingment and entrainment of fish, radiological effects, and the disposal of nuclear wastes.

Steam generating plants are expansive installations that can present a relatively unsightly overall appearance which often intrude on scenic areas. Concealment of transmission towers and transmission lines is sometimes difficult; they cannot always be placed out of view or effectively blended into the surroundings.

The types and quantities of emissions from the combustion of fossil fuels in the production of electric power created a demand for air pollution control as a major siting criteria in planning future plants. The effects of releasing large quantities of cooling water in a heated condition and its impact on aquatic life are other issues of controversy.

During their operation, nuclear power plants are permitted to release, under well controlled and carefully monitored conditions, low levels of radioactivity. Current technologies for the treatment and storage of radioactive wastes are characterized as adequate. The adequacy of these technologies, however, is controversial.

With increasing emphasis on environmental protection, the utility industry, in cooperation with the Federal Government, some state governments, and some research institutions, has ongoing programs which are attempting to find ways to minimize the environmental impacts of electric power generation and still maintain a reasonable cost for electric power.

FUTURE ELECTRIC POWER NEEDS, SUPPLIES, AND PROBLEMS

Projected Demands

In general, the projections of demand for the Future Conditions Report were developed by extrapolating various historical trends and subjectively modifying those trends to reflect judgments regarding factors currently in force and which could plausibly continue into the future. The projections chosen reflect a belief that growth in the use of electric power will continue but at a somewhat reduced rate. This approach is believed to be moderately conservative with regard to the potential for energy conservation but recognizes the significant role electric power will continue to play in the National economy.

Even with "conservative" growth rates, the total use of electricity in the Chesapeake Bay Market Area is expected to increase by a factor of over five times by the year 2000 and approximately 13.5 times by the end of the projection period. As shown in Figure A-17, the Chesapeake South Sector which includes the major metropolitan areas of Norfolk-Portsmouth, Hampton-Newport News, Richmond, and the Virginia suburbs of Washington, D.C., is expected to experience the highest rate of increase. While the rates of growth for the other sectors are lower than those of Chesapeake South, the rates still reflect significant increases in electricity requirements for these sectors by the year 2020.

Supply Methodolgy

The power supply facilities projected through 1985 are either in service, under construction, or in the advanced design stage. Accordingly, the projected supply picture through this period reflects the generation already planned by utilities in the Market Area at this writing.

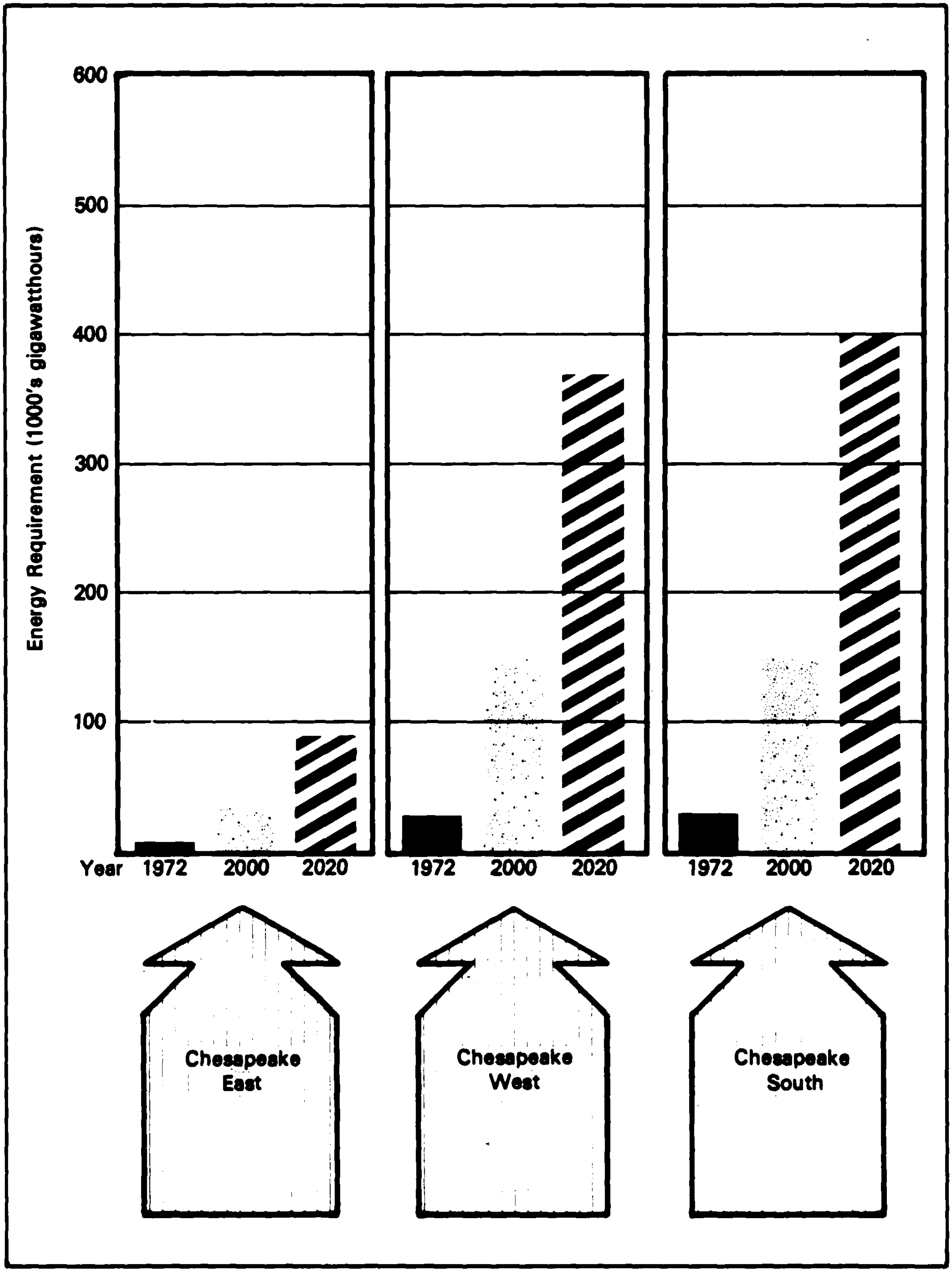

FIGURE A-17 PROJECTED ENERGY REQUIREMENTS FOR THE CHESAPEAKE BAY MARKET AREAS

For the years after 1985, the supply projections utilized current and expected trends in the relative proportions of steam generation to total generation and of nuclear generation to fossil. The capacity projected assumes all units prejected for meeting Market Area loads after 1985 are located within the Market Area.

With regard to future water consumption and withdrawal rates by power plants, once-through cooling is prohibited under the present EPA regualtions on all plants scheduled for service in 1985 and thereafter. Plants scheduled before 1985 employing the once-through system may retain them throughout the remainder of their useful lives. For this study, it is assumed that all projected capacity on line after 1985 will employ the wet towers cooling method.

Projected Supply and Plant Location

It is projected that by the year 1985, approximately 44 percent of the Market Area's total energy will be generated in nuclear power plants. By 2000, the percentage is expected to increase to 67 percent and to 72 percent by 2020. Fossil fuel steam plants are expected to remain the major source of electric power to the year 1985 at whcih time they are expected to generate 50 percent of total Market Area energy requirements. By the year 2000, however, fossil fuel's share dips to 29 percent and to 26 percent by 2020. It is anticipated that the remainder of the energy requirements will be met by hydroelectric and combustion type plants and possibly other generating modes presently not available.

For the plant locations shown in Figure A-18, consideration was given only to steam-electric plants, both nuclear and fossil fuel, because of their demands for cooling water and consequent potential impacts on the aquatic environment and shoreline areas. These two means of generation are expected to produce about 96 percent of the electrical energy required in the Chesapeake Bay Market Area in 2000. The locations of future facilities is fairly well known through 1985; but, for installations scheduled beyond 1985, there is a great deal of uncertainty regarding specific sites. The location of these plants was based on several criteria including the availability of amply water supply, proximity to lead centers, and the need to keep transmission lines short. In addition, sites in Maryland were selected in accordance with criteria developed by the Maryland Power Plant Siting Program, although these sites were not necessarily those chosen under the Siting Program.

Because of the degree of uncertainty attending site location in the long-range future, no attempt was made to prodict where plants would be located beyond 2000.

Cooling Water Considerations

Water withdrawals are expected to decrease over the projection period so that by 2020 withdrawals will be considerably less than those in 1972. Water consumption, however, is projected to increase at a greater rate. This apparent discrepancy is due to two factors. First, once-through cooling systems, which have much higher withdrawal rates that other types of colling systems, are prohibited on all plants scheduled to begin service during or after 1985. Second, it was assumed that cooling towers would be used for all projected plants after 1985. The result of this increase in water consumption will be reduced freshwater inflows into the Bay. As pointed out earlier in this chapter, this could disrupt the Bay's ecosystem and impact negatively upon the social and economic integrity of the Region. The effects of reduced inflows must be carefully investigated.

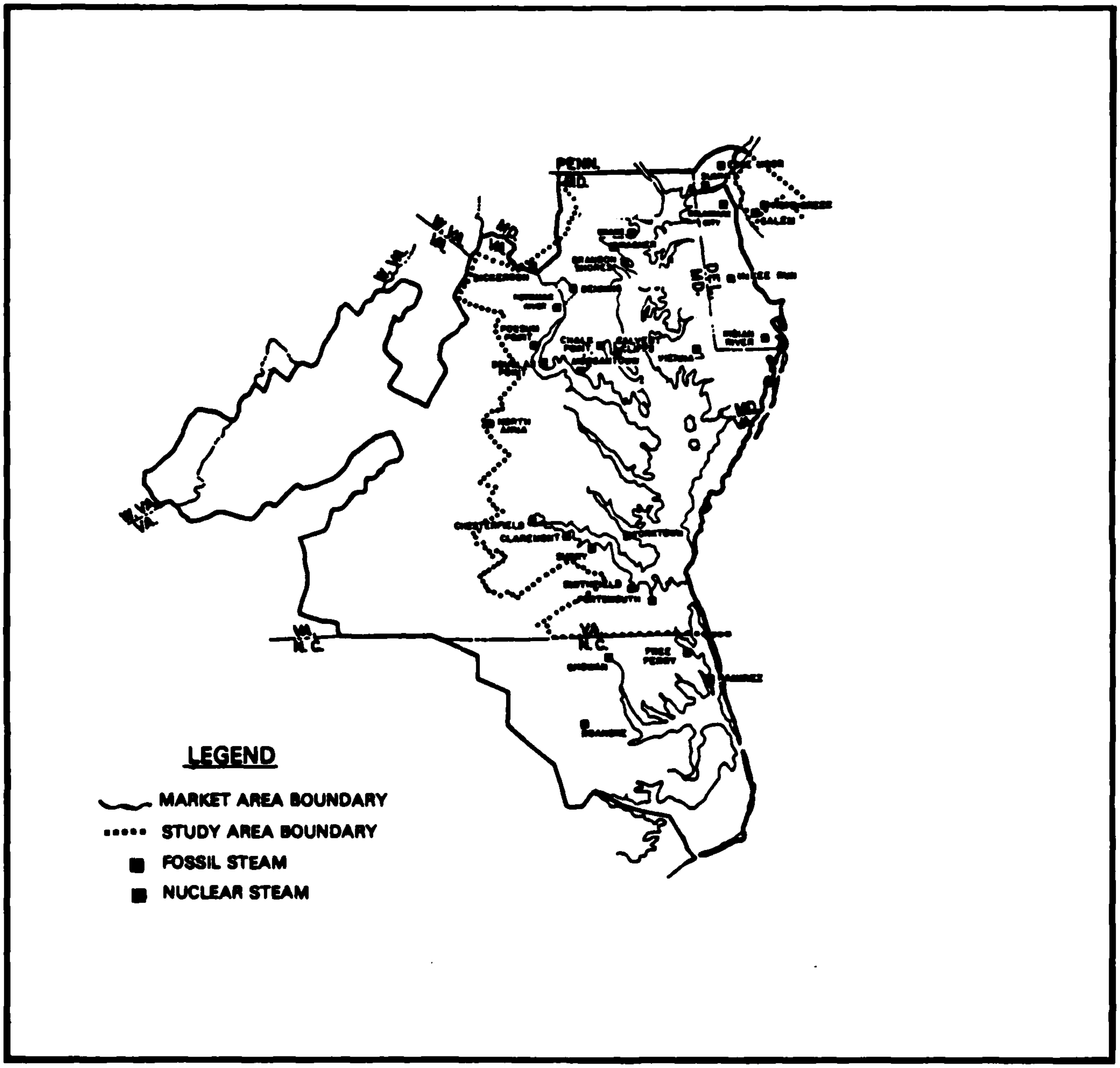

FIGURE A-18 CHESAPEAKE BAY PLANT LOCATION MAP 2000

Land Use of Power Facilities

Estimates of electric utility land use in the Chesapeake Bay Study Area were restricted to that required for large steam electric plants and the related high-voltage transmission rights-of-way. No attempt was made to estimate land use requirements associated with subtransmission or distribution facilities.

Table A-23 shows projected land requirements for power plants within the Chesapeake Bay Region. The magnitude of the land needed for future power plant sites is obvious when it is realized that the area of Washington, D.C., is about 42,900 acres.

TABLE A-23
PROJECTED LAND FOR STEAM ELECTRIC PLANTS
IN THE CHESAPEAKE BAY STUDY AREA (ACRES)

	1985	2000	2020
Chesapeake East	3,300	8,400	21,800
Chesapeake West	6,700	16,500	41,300
Chesapeake South	6,100	9,200	26,700
TOTAL CHESAPEAKE BAY REGION	16,100	34,100	89,800

It is reasonable to assume that the land occupied by future transmission lines will also increase significantly in the future, especially considering the fact that nuclear plants will have to be located further away from population centers for safety reasons. This is somewhat offset by the fact that transmission lines will probably have a higher capacity in the future.

NOXIOUS WEEDS

As previously mentioned, the aquatic plants which inhabit Chesapeake Bay waters are very important and serve as the primary producers or vital lifeline for other Bay species. However, as with any resource, an overabundance can also lead to problems. With some aquatic plants, excessive growth or heavy concentrations can cause conflicts and actually restrict the use of other resources. At this point, these plants become a hindrance and are termed "noxious weeds." Problems arise when the plants occur in such a place or to such an extent that they limit other beneficial water related uses such as navigation, recreation, fish and wildlife, water quality, and public health.

While certain aquatic plants have caused problems in the Bay Region in the past, today only an occasional isolated report of a noxious weed problem can be found. The problem species are still present in the Bay waters, but only as mere fragments of previous volumes, and none in sufficient numbers to require comprehensive control measures.

The three types of aquatic plants which have, in the past, caused the most widespread problems in Chesapeake Bay include Eurasian watermilfoil, water chestnut, and sea lettuce. Eurasian watermilfoil, a submerged aquatic plant which flourishes in water ranging from fresh to 15 ppt salinity, caused some problems in the late 1950's to early 1960's in the Gunpowder and Middle River areas of the northern Bay and in tributaries of the Potomac and Rappahonnock Rivers in the lower Bay Area. Water chestnut problems, which occur near tributary headwaters, (as the plant can tolerate no salinity) have been documented in the Gunpowder and Sassafras Rivers around the early 1960's. Finally, sea lettuce, growing in saline waters over 12 ppt, has caused problems in tributaries of the Potomac River and near the Norfolk Area in the mid-1960's.

Although present water resource utilization is not hindered by the presence of aquatic plant growth in the Chesapeake Bay, the potential exists for problems to develop in the future.

An emergency aquatic plant problem is the increase in Hydrilla verticillata (hydrilla) in the Washington, D.C., area. The Potomac River and several freshwater impoundments in the Washington area are becoming invested with hydrilla at an alarming rate. Planning efforts are presently underway to address the problem.

SELECTION OF PROBLEMS FOR DETAILED STUDY

INTRODUCTION

As can be seen from the findings of both the Existing Conditions Report and the Future Conditions Report presented in the preceding section, there are a myriad of either existing or emerging water resource related problems in the Chesapeake Bay Region that require resolution. Depending on the nature and the Bay-wide significance of these problems, the responsibility for addressing a specific problem and then implementing a solution rests with either the local, state, or Federal government or a combination of various levels of government. In this regard, there are numerous studies and research programs underway at all levels of government that are addressing various Bay-related problems.

In order to select the detailed study and model testing program, an analysis was conducted to establish what role the Corps of Engineers Chesapeake Bay Study played within this spectrum of ongoing studies and research. In defining this role, emphasis was placed on (1) selecting problems for study that were considered to be high priority and that have Bay-wide significance, (2) maximizing the use of the Chesapeake Bay Hydraulic Model, (3) avoiding any duplication of work being conducted under other existing or proposed programs, and (4) being responsive to the original intent of the Congress as specified in the study authorization.

Based on the previously mentioned Existing and Future Conditions reports and specific inquiries of potential users, a list of high priority problems that had potential for study and hydraulic model testing was developed and is included as Table A-24. Because there was not sufficient time to adequately address all the problems arrayed on this table, the list was screened and the study program was selected based on the criteria discussed in the preceding paragraph. The following paragraphs discuss this selection process in detail.

INITIAL MODEL TESTING PROGRAM

The initial screening of the potential model studies listed on Table A-24 was conducted in concert with the Advisory Group and the Steering Committeee. It was assumed there would only be a one-year testing program and that the Chesapeake Bay Study would terminate after the initial year of testing. Under this approach, no in-depth analysis would be made of the data collected. Given the large number of potential studies it became necessary to conduct a formulation exercise to select a testing program. One element of the formulation process involved assigning a priority to each individual study to insure that the one year of available testing was used in the most productive and economic manner. The priority rating was established based on the probable environmental, social and economic impacts of the various problems that would be addressed through each potential test.

Each problem impact category (i.e., environmental, social, and economic) was rated by estimating both its magnitude and severity. The magnitude of an environmental impact was based on the area of the Chesapeake Bay system affected. Social and economic impact magnitude were expressed in terms of the number of people affected. Problem severity for each problem impact category was expressed as an estimate of the intensity of the insult. The numerical index value of problem magnitude and severity for each impact category (environmental, social, and economic) was based on an ascending scale of 1 to 5. The number 1 indicates a mild impact—the number 5 indicates a most severe impact.
The criteria used to develop the index values for the magnitude of the environmental, social, and economic impacts for this analysis are shown below:

PROBLEM MAGNITUDE INDEX

Index Value		Magnitude
1	Area:	Less than 5 percent total water area of the Chesapeake Bay system
	Population:	Cities less than 100,000 population, county or groups of counties less than 150,000
2	Area:	5 percent to 15 percent total water area
	Population:	Cities 100,000-500,000 population Small groups of rural counties (e.g., Southern Maryland)
3	Area:	15 percent to 25 percent total water area
	Population:	Cities 500,000 to 1,000,000 Moderate size group of counties (i.e., Northern Neck of Virginia)
4	Area:	30 percent to 50 percent total water area
	Population:	City larger than 1,000,000 Large group of rural counties

TABLE A-24
POTENTIAL MODEL STUDIES

ESTUARINE PROCESSES STUDIES

Low Freshwater Inflow Study
High Freshwater Inflow Study
Water Exchange Among Tributaries
Determination of Circulation Patterns
Tidal Flooding Study
Movement of Hydrogen Sulfide in Lower Bay

MUNICIPAL WATER SUPPLY STUDIES

Potomac River Estuary Water Supply
Baltimore-Susquehanna River Diversion
Rappahannock River Estuary Water Supply
Susquehanna-Potomac Water Diversion
Upper James River (Hopewell and Richmond) Water Supply
James-York Diversions

POWER PLANT EFFECTS STUDIES

Proposed Upper Bay Power Plant Thermal Effects Study
Proposed Lower Bay Power Plant Thermal Effects Study
Upper Bay Power Plants Cumulative Thermal Effects Study
Lower Bay Power Plants Cumulative Thermal Effects Study
Potomac River Power Plants Thermal Effects Study
James River Power Plants Thermal Effects Study
York River Power Plants Thermal Effects Study
Rappahannock River Power Plants Thermal Effects Study

NAVIGATION STUDIES

Baltimore Harbor Channel Enlargement Study
North Bay Dredged Material Containment Area Study
Norfolk Harbor Channel Enlargement Study
South Bay Dredged Material Containment Area Study
Bay-Wide Dredged Materal Disposal Study
York River Channel Enlargement Study
Crisfield Harbor Construction Study
Cape Charles Harbor Channel Enlargement Study

WASTEWATER STUDIES

Upper and Lower Bay Wastewater Dispersion Study (EPA)
Potomac River Estuary Wastewater Dispersion Study
Patuxent River Estuary Wastewater Dispersion Study
James and Elizabeth Rivers Wastewater Dispersion Study
Patapsco River Estuary Wastewater Dispersion Study

TABLE A-24 (Cont'd)
POTENTIAL MODEL STUDIES

Back River Wastewater Dispersion Study
Chester River Wastewater Dispersion Study
Choptank River Wastewater Dispersion Study
York River Wastewater Dispersion Study
Rappahannock River Wastewater Dispersion Study
Upper and Lower Bay Nutrient Equilibrium Study

DEVELOPMENT OF NUMERICAL MODELS

Determination of Dispersion Coefficients
Verification of Numerical Tidal Model
Determination of Water Masses in Three Dimensions
Calibration of Numerical Hydrodynamic Model

SEDIMENT TRANSPORT STUDIES

Sediment Transport in Upper Bay
Sediment Transport in Potomac River Estuary
Sediment Transport in Rappahannock River Estuary
Sediment Transport in York River Estuary
Sediment Transport in James River Estuary
Sediment Transport in Chester River Estuary

5	Area:	Greater than 50 percent total water area
	Population:	Several large metropolitan areas

Problem magnitude indices were relatively simplistic reflecting the population and water area impacted by various problems. These indices were applied to all of the three problem impact categories (environmental, social, and economic) quite easily. On the other hand, development of indices reflecting problem severity was a much more involved process, in that many more parameters were considered.

The important factors considered in generating indices expressing the severity of environmental problems related to disruption of ecologically important areas or species (wetlands, spawning areas, waterfowl habitat, oyster beds, fish of both sport and commercial value). These disruptions, though they can occur naturally, (floods, erosion problems, etc.) are primarily a function of the works of man, (wastewater dispersion, heated discharges, increasing nutrient levels, upstream water diversions).

The criteria used for developing indices of the severity of the environmental impacts follow:

ENVIRONMENTAL IMPACT SEVERITY INDEX

Index Value	Problem Severity
1	Minimal temporary disruption of a few species or areas. No irreversible losses.
2	Significant temporary disruption of a few species or areas. No irreversible losses.
3	Permanent destruction of a few important species or areas. The overall ecosystem of the area, though permanently altered, will retain most of its original basic characteristics.
4	Permanent destruction of several important species or areas. The overall ecosystem of the area as well as some of its basic characteristics will be altered.
5	Permanent disruption of the entire ecosystem or resource area beyond any recovery.

When there was uncertainty concerning the potential severity of the environmental impacts, a conservative approach that considered the long-term integrity of the environment was followed.

There were many factors considered in deriving severity indices describing the social impact of problems. Among these were threats to public health and safety from severe bacteriological and chemical water pollution, dislocations of people or industries because of water quality, erosion/sedimentation or flooding problems, destruction of aesthetic or recreational areas, and limiting fields of personal development, to name a few. The criteria establishing the social severity index value follow:

SOCIAL IMPACT SEVERITY INDEX

Index Value	Problem Severity
1	Minimal loss of recreational opportunities. All types of recreation still available with some curtailment, minor reversible aesthetic degradation, no threat to public health or possibility of population dislocation.
2	Significant curtailment of recreational opportunity. Significant aesthetic degradation. No threat to public health or possibility of population dislocation.
3	Total loss of several important recreational opportunities, curtailment of others. Considerable aesthetic degradation. Minor threat to public health. Some minor population dislocation.
4	Total loss of many recreational opportunities, curtailment of others. Severe aesthetic degradation. Major population dislocation due, for example, to extensive flooding. Significant threat to public health.
5	Total loss of water-related recreational opportunity. Severe threat to public health. Major population dislocations due to major flooding, erosion, etc.

The important factors considered in assessing the degree of economic impact consisted of the impact on employment and income, the impact on the competitive advantage of the area with respect to suitability for new or existing industrial location (for instance, water transportation costs in an area may increase because of siltation problems; this would decrease an area's competitive advantage for industries which rely on raw materials shipped by water), effect on water treatment cost for municipalities and industries, and damages or losses of property due to flooding or erosion problems. These combinations were interpreted into indices for measuring the economic impact of the various problems as follows:

ECONOMIC IMPACT SEVERITY INDEX

Index Value	Problem Severity
1	Minimal effects on employment and incomes, some impact on water treatment costs, minor losses or damages to property due to occasional minor flooding or low rates of erosion, insignificant losses in competitive advange or efficiency, but not enough to affect the decision of a company not to locate, close down, or expand.

2	Minor effects on employment and incomes, significant impact on water treatment costs, minor losses or damages to property due to frequent minor flooding or moderate rates of erosion, significant losses in competitive advantage or efficiency, but not enough to affect the decision of a company not to locate, close down, or expand.
3	Significant effects on employment and incomes, major increases in water treatment costs, significant damages and losses in property due to frequent minor flooding or occasional to moderate heavy floods, or moderate rates of erosion, sufficient losses in efficiency and competitive advantage to cause some firms which would have located in the area in the absence of the problem not to locate there, or cause some existing firms to cut back production or close down.
4	Severe impact on employment and incomes, significant losses or damages to property due to frequent minor flooding or moderate rates of erosion, significant loss in efficiency and competitive advantage to cause many firms which would have located in the area in the absence of the problem not to locate there, or cause many existing firms to cut back production or close down.
5	Severe impact on employment and incomes, heavy losses or damages to property due to frequent heavy floods or very high rates of erosion, severe loses in competitive advantage sufficient to prevent most water-dependent firms from locating in that area, and causing most existing firms to close down.

Given the aforementioned impact indices, the potential model studies were evaluated and an overall rating was assigned to each study. Table A-25 lists the ratings that were assigned to each study. It should be emphasized that the ratings were subjective and all but meaningless standing by themselves; however, the ratings did serve as one means of comparing the various studies. In addition to the above impact ratings the following criteria were also used in the decision process.

a. The importance of the particular study to the Corps' Chesapeake Bay Study.

b. The formulation of a hydraulic study program that can be completed within the funding and time constraints of the presently authorized Chesapeake Bay Study, and that most economically utilizes the available resource, e.g., labor, instrumentation, etc.

c. Hydraulic studies that are not only presently necessary, but may be of use in the future.

d. Hydraulic studies that demonstrate the utility and versatility of the hydraulic model.

e. The demand for a particular study by other public agencies or interested groups.

The list of studies was then examined in light of the foregoing criteria for the purpose of selecting those study problems that should be accomplished during the first year of model testing. The selected first year program consisted of the following studies.

1. Low Freshwater Inflow Study. The purpose of this investigation was to study the effects on the salinity regime of the Chesapeake Bay system of decreased freshwater inflows due to drought and man-related modifications.

2. Baltimore Harbor Study. This work defined the effects on the estuarine system of deepening the Baltimore Harbor channels to a depth of 50 feet. Included were studies concerned with rates of harbor flushing, dispersion of wastes, salinity intrusion, and changes in shoaling rates and patterns.

3. Potomac River Estuary Water Supply and Waste Water Dispersion Study. This study was designed to explore the ramifications of using the Potomac River Estuary as a supplemental source of water supply for Washington, D.C. One of the primary concerns regarding using the estuary as a source of water supply was the possibility of recyling wastewater into the water supply intake system during periods of low freshwater inflow and the possibility of changing salinity levels and current patterns in the Potomac Estuary.

EXPANDED STUDY PROGRAM

During the selection of the above first year program it became apparent that there were many problems in the Chesapeake Bay which could be solved only in the context of hydraulic model studies program far beyond that which could be accomplished in a one year period. It was also apparent that if such a model studies program were undertaken, it should be formulated in the context of a resources study which would provide for the development of a meaningful hydraulic model studies program. Further, the model studies data should be used in the resources study as an aid in formulating problem solutions. In 1975 the Corps prepared a revised scope of work recommending an expanded study program and a total of four years of model testing.

Following approval of the concept of an expanded study and model testing program, a study program was selected and documented in the Revised Plan of Study published in October 1978.

In selecting the study program recommended in the October 1978 Revised Plan of Study the potential study candidates listed in Table A-24 were again reviewed. Based on this review it appeared that at least a portion of the future study and model effort to be funded by the Chesapeake Bay Study should be directed toward studies of extraordinary natural events that have Bay-wide impact or significance.

TABLE A-25
PROBLEM IMPACT INDICES

Technical Problem Areas	Environmental Impact Indices Severity	Environmental Impact Indices Magnitude	Social Impact Indices Severity	Social Impact Indices Magnitude	Economic Impact Indices Severity	Economic Impact Indices Magnitude	Indices Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A. Bay-Wide General Tests							
1. Low Freshwater Inflow Study	3	5	3	4	2	4	21
2. High Freshwater Inflow Study	2	5	3	4	2	4	20
3 Tidal Flooding Study	2	5	3	4	3	4	21
B. Municipal Water Supply							
1. Potomac River Estuary Water Supply Study	2	2	4	4	2	2	18
2. Baltimore-Susquehanna River Water Supply Diversion	1	3	1	4	1	4	14
C. Power Plant Thermal Discharge Studies							
1. Proposed Upper Bay Power Plant Thermal Effects Study	3	1	2	5	2	5	18
2. Cumulative Lower Bay Power Plant Thermal Effects Study	3	1	2	5	2	5	18
3. Cumulative Upper Bay Thermal Effects Study	3	3	2	5	2	5	20
D. Navigation Studies							
1. Baltimore Harbor Channel Enlargement Study	3	3	3	4	4	4	21
2. North Bay Dredged Material Disposal Study	5	1	3	4	4	4	21
3. Norfolk Harbor Channel Enlargement Study	3	2	3	3	4	3	18
4. South Bay Dredged Material Disposal Study	4	1	3	3	4	3	18
5. York River Channel Enlargement Study	3	1	3	1	3	1	12
E. Waste Water							
1. Potomac River Estuary Waste Water Dispersion Study	3	2	3	4	1	4	17
2. Patuxent River Estuary Waste Water Dispersion Study	3	1	3	2	1	2	12
3. James and Elizabeth Rivers Estuaries Waste Water Dispersion Study	3	2	3	4	1	4	17
4. Patapsco River Waste Water Dispersion Study	3	2	3	4	1	4	17
5. Back River Waste Water Dispersion Study	3	1	2	4	1	2	13

More specifically, these rare natural events include:

1. Periods of prolonged low freshwater inflow from the Bay's tributaries.

2. Periods of high freshwater inflow from the Bay's tributaries.

3. Tidal flooding caused by unusual climatological/meterological conditions.

In considering the advisability of conducting additional studies of these rare events, the following points were considered to be pertinent.

1. These events all have significant Bay-wide impacts on the natural resource.

2. The impacts of these rare events are intensified because of man's use of the Bay and its resources.

3. There is a lack of data/understanding of the physical changes that occur in the estuarine system as a result of these rare events. Further, the impact on both the resource itself and man's use of the resource is not well defined.

4. There is no existing Federal or state program that is addressing the nature and impact of these rare events on a Bay-wide basis.

5. The problems and resource conflicts associated with these events have all been ranked as high priority by the Steering Committee.

6. All of these rare events may be duplicated and evaluated using the Chesapeake Bay Hydraulic Model.

Based on the above considerations there appeared to be strong justification for conducting comprehensive studies of these rare events as part of the expanded study program.

A further review of the potential tests listed in Table A-24 yielded some additional candidates for study under the expanded program. Chief among these candidates were the Bay-wide Nutrient Equilibrium Study and the Bay-wide Dredged Material Containment Study. While these two studies would definitely be addressing problems that have Bay-wide significance, they were not considered to have as high a priority as those previously mentioned. In addition, both of these studies had some potential for overlap with existing programs.

The time required to conduct both the initial testing program and the tests specifically requested by others was such that the time remaining in the testing period was not sufficient to warrant consideration of any tests in addition to those studies discussed in the preceding paragraphs. Given the initial program, the work for others, and the five potential studies, the next step in the selection process was to formulate an optimum extended program that was responsive to the established criteria and that also provided ample opportunity for testing by others.

The testing program identified in the first screening appeared to be valid; however, a modification to the Low Freshwater Inflow Test enhanced the compatibility of this test with the work contemplated in the expanded program. This test was expanded to provide

the initial data needed for a comprehensive low freshwater inflow study which was considered to be the highest priority study in the extended program. Even with extending the length of the Low Freshwater Inflow Test, the Potomac Estuary Test could still be conducted in time to provide the required input to the Metropolitan Washington Area Water Supply Study.

Proceeding in this manner appeared to be very attractive in that it did not disrupt the work accomplished to date on the initial program, yet it provided data that would be of immediate use in the expanded program. The initial program as reformulated above required nearly two years of model testing.

Following the above tests, the next two tests from a priority standpoint were a series of Thermal Effects Tests requested by the State of Maryland and the Tidal Flooding Test which would be required in support of a comprehensive Bay-wide tidal flooding study. As the Thermal Effects Test was considered to be of slightly greater importance and all tests to this point in the program were Corps funded, it was considered desirable to conduct the Thermal Effects Test before the Tidal Flooding Test. The addition of these tests raised the total model testing time to approximately 2 years and 9 months.

With the addition of the two preceding tests, approximately 8 months of testing time remained within the testing program. The tests remaining for consideration in the program included the High Freshwater Inflow Test, the Dredged Material Containment Area Test, the Nutrient Equilibrium Test and the EPA Wastewater Dispersion Testing. Of these four remaining tests, the High Freshwater Inflow Test and the EPA Wastewater Dispersion Testing have the highest priority. Since the scope of the EPA testing and a committment from EPA were not available at the time, the High Freshwater Inflow Test was to be conducted following the Tidal Flooding Test. The remaining 3 months of the four year testing program was tentatively scheduled for the EPA tests. In the event a testing program could not be developed in concert with EPA, the remaining testing period could be used for either of the two remaining tests. It was considered to be premature at that time to assume that any particular test would be substituted for the EPA testing.

Based on the formulation process explained in the preceding paragraphs of this analysis, it was recommended that the expanded Chesapeake Bay Study and Testing Program be composed of the following testing and studies:

1. Baltimore Harbor Channel Enlargement Test
2. Comprehensive Low Freshwater Inflow Testing
3. Potomac River Estuary Water Supply and Wastewater Dispersion Test
4. Proposed Upper Bay Power Plant Thermal Effects Test
5. Upper Bay Cumulative Thermal Effects Test
6. Tidal Flooding Testing and Study
7. High Freshwater Inflow Testing and Study
8. Bay-wide Wastewater Dispersion Test

Of the above, the Low Freshwater Inflow, Tidal Flooding and the High Freshwater Inflow Tests were the three programs selected for detailed analysis as part of the Chesapeake Bay Study Program. The other testing was to be conducted in support of other Corps' studies or the programs of others. The following paragraphs provide a brief overview of the scope and objectives of the three studies selected for detailed analysis in the Chesapeake Bay Study.

LOW FRESHWATER INFLOW STUDY

As an estuary, Chesapeake Bay is dependent on the inflows of freshwater from its drainage basins to maintain the salinity regime that characterizes its ecosystem. Although the many species that live in the Bay year-round and others that utilize it only in various portions of their life cycle are generally able to thrive in the daily seasonal, and yearly variations in salinity, drastically reduced inflows during a drought period, or reductions in inflow of less drastic magnitudes over a longer period of time, can impose environmental stress by threatening the health or even survival of species sensitive to particular ranges of salinity. Periods of low freshwater inflow can limit spawning opportunity and also alter existing estuarine flushing characteristics and circulation patterns. In addition to possible impacts on the Bay's biota, this phenomenon may have serious implications in the area of wastewater dispersion. In short, the character of Chesapeake Bay and the health and well-being of the ecosystem are dependent on established physical, chemical, and biological patterns in the Bay. These are in turn intimately related to the volumes of freshwater inflows to the Bay and the seasonal variations in those flows.

The potential for damage to the Bay from reduced inflows has provoked concern on the part of the scientific community and the public at large. As stated in the Susquehanna River Basin Report of 1970, for example:

> It is important to note projected changes in Susquehanna River flows in order to assess the impact of developments in the Susquehanna Basin on the Bay ecosystem. Research and analysis to date have been insufficient to permit determination of the effects of incremental modification in Susquehanna River-Chesapeake Bay hydrology on the ecology of the Bay.

The report states further that due to these problems:

> Carefully conceived research, including the use of hydraulic and mathematical models, is essential to the development of needed information for sound future policy and management decisions concerning the Chesapeake Bay.

It is recognized that continued growth and development in the basins above the Chesapeake will require additional amounts of water for municipal, industrial, and agricultural purposes. In addition, the development of electric power generation facilities in the future may markedly increase the amounts of water consumed.

In the Susquehanna River Basin, for example, consumptive losses due to power generation activities are projected to increase from 30 cfs in 1970 to 300 cfs in 2020. Concern about the effects that these losses may have in Chesapeake Bay has been enough to prompt written requests from the Susquehanna River Basin Commission for testing on the hydraulic model. The types of problems associated with future growth in the Susquehanna Basin apply equally well to other major Bay tributaries.

The Low Freshwater Inflow Study was conceived through the identified need for management of freshwater inflows to the Bay. The study was to provide a better understanding of the relationship between Chesapeake Bay salinities and the freshwater inflow from its tributaries. The study's second objective was to define the environmental and socio-economic impacts of both short and long term reductions of the freshwater

inflow into Chesapeake Bay. The third objective was to recommend those minimum flows that should be provided by the major tributaries in order to maintain the integrity of the Bay. A major portion of the work to be done was to be based on the results of testing conducted on the Chesapeake Bay Hydraulic Model. These tests provide the base data needed to describe the salinity-inflow relationships occurring under a variety of freshwater inflow conditions.

TIDAL FLOODING STUDY

It has been the Bay Region's good fortune not to have experienced a major tidal storm for a number of years. During this time, development within the flood plain has intensified. The attractiveness of the shore environment has caused continued development of large tracts of land adjacent to the Bay for residential as well as commercial and industrial purposes. Thus, the potential for increased loss of life and property, hazards to health, disruption of normal economic activities, and the cost of evacuation and rehabilitation will be greater than those experienced in past floods.

As noted in the Water Resources Problems section of this supplement, 60 communities are considered to be floodprone based on an assessment of how many acres of intensive development would be inundated by the occurrence of a Standard Project Tide. Of these 60 communities, 30 were determined to have critical problems. The flood problem was considered to be critical if 25 acres or more of intensively developed land would be inundated by the Intermediate Regional Tidal Flood (i.e., approximately the 100-year tidal flood) and if it also appeared that the existing development would suffer significant damage from that same flood.

The Tidal Flooding Study had three primary objectives. First, to provide a better understanding of the tidal flood stage-frequency relationship in the Bay Region as a whole and also in communities which are subject to tidal flooding. Second, to define the environmental and socio-economic impacts of tidal flooding in flood-prone communities. Finally, to recommend structural or non-structural tidal flood protection in those communities where it is found to be economically and environmentally feasible and socially acceptable.

HIGH FRESHWATER INFLOW STUDY

The third study that was to be conducted as a part of the Chesapeake Bay expanded program was the High Freshwater Inflow Study. As witnessed by the $42 million in Bay damages caused by the large influx of freshwater from Tropical Storm Agnes, high volumes of freshwater can be detrimental to both Chesapeake Bay itself and the residents of the Bay Region. A special study entitled Impact of Tropical Storm Agnes on Chesapeake Bay, prepared by the Baltimore District, noted the impacts and many problems associated with this high flow event. Among the impacts investigated were hydrologic, geologic, water quality, biological, economic, and public health. The major findings for each type of impact were:

Hydrologic -- a 15 times greater than normal flow rate near the mouth of the Susquehanna River resulting in a 30 nautical mile translation of saline waters down the Bay.

Geologic — increased erosion rates on Bay shorelines and the deposition of nearly 31 million metric tons of sediment into the Bay from the Susquehanna River; more than had been contributed in the previous 10 years.

Water Quality — high concentrations of raw sewage in most of the Bay's tributaries as well as the input of over 1500 tons of phosphorus and 2500 tons of nitrates from the Susquehanna drainage area.

Biological — heavy mortalities suffered by the softshell clams and oysters because of their inability to move to more saline waters and a large reduction in submerged aquatic plants.

Economic — damages to the shellfish and finfish industries totaled nearly $34 million; the recreation industry suffered damages of approximately $7 million; and boat and shipping industry damages amounted to nearly $2 million.

Public Health - the Bay-wide closure of both shellfishing areas and Maryland bathing beaches for a period of nearly one month.

Based upon the magnitude of these impacts and in response to requests from the scientific community to more adequately describe the physical changes that occur in the Bay during high flow events, the High Freshwater Inflow Study was proposed. The High Freshwater Inflow Study had three major objectives. First, to provide a better understanding of the relationship between Chesapeake Bay salinities and high freshwater inflows from its tributaries. Second, to define the environmental and socio-economic impacts of high freshwater inflows into Chesapeake Bay. Finally, to identify those structural or management measures that could be used to prevent or reduce the adverse impacts of high freshwater inflows.

REVISIONS TO EXPANDED STUDY PROGRAM

For a number of reasons, the most significant of which being the lack of sufficient funding, the study and testing program as recommended in the 1978 Revised Plan of Study was not conducted. Rather, the expanded study program was limited to the Low Freshwater Inflow Study and the Tidal Flooding Study. Both of these studies were also somewhat reduced in scope from that originally planned. For a complete description of these studies and their findings the reader is referred to the Chesapeake Bay Low Freshwater Inflow Study and the Chesapeake Bay Tidal Flooding Study. The testing that was conducted for others is discussed in more detail in Supplement C - The Chesapeake Bay Hydraulic Model.

CHESAPEAKE BAY STUDY

SUMMARY REPORT

SUPPLEMENT B

PUBLIC INVOLVEMENT

Department of the Army
Baltimore District, Corps of Engineers
Baltimore, Maryland
September 1984

CHESAPEAKE BAY STUDY
SUMMARY REPORT

SUPPLEMENT B
PUBLIC INVOLVEMENT

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SUPPLEMENT B

PUBLIC INVOLVEMENT

INTRODUCTION

Citizen interest in water and related land resource planning and the desire to take part in the planning process has resulted in public involvement becoming an integral part of the planning process. This increased citizen interest requires a commitment from both the citizen and the planner to be willing to communicate with each other. Once effective communication is established, common goals can be defined, conflicts resolved, and agreement reached on proposed solutions to the problems.

The public involvement program discussed in this supplement was designed to establish effective communication between the planners and the many "publics" during the conduct of the study. The term "public" is defined as "any affected or interested non-Corps of Engineers entity." This includes other Federal, state and local government agencies as well as public and private organizations and individuals.

PURPOSE OF THE PROGRAM

The overall purpose of the public involvement program for the Chesapeake Bay Study was to provide an organized set of activities which served to establish functional two-way communication between the study participants and the many "publics" represented in the Bay area. The specific objectives of the public involvement program were as follows:

1. To further identify all those elements of the public that are affected by and interested in Chesapeake Bay including Federal, state, and local agencies, institutions, organizations, and individuals.

2. To identify as a continuing effort the most effective means of involving the public in the Chesapeake Bay Study.

3. To inform the public of the Chesapeake Bay Study to include information on both the resource study and the Chesapeake Bay Hydraulic Model.

4. To obtain the public's comments and perceptions of problems, needs, desires, and related impacts with regard to the Bay's resources and use priorties, and incorporate those opinions into program recommendations by the most effective means possible.

PUBLIC INVOLVEMENT PROGRAM

The three basic measures used to promote the public involvement program stressed a two-way communication process. These three measures provided for: (1) general information, (2) interaction-dialogue, and (3) review-reaction. Each measure was designed to reach different levels of the public in the study area, as shown in Figure B-1. Likewise, each measure was geared to evoking a different degree of involvement and response from each level of the public.

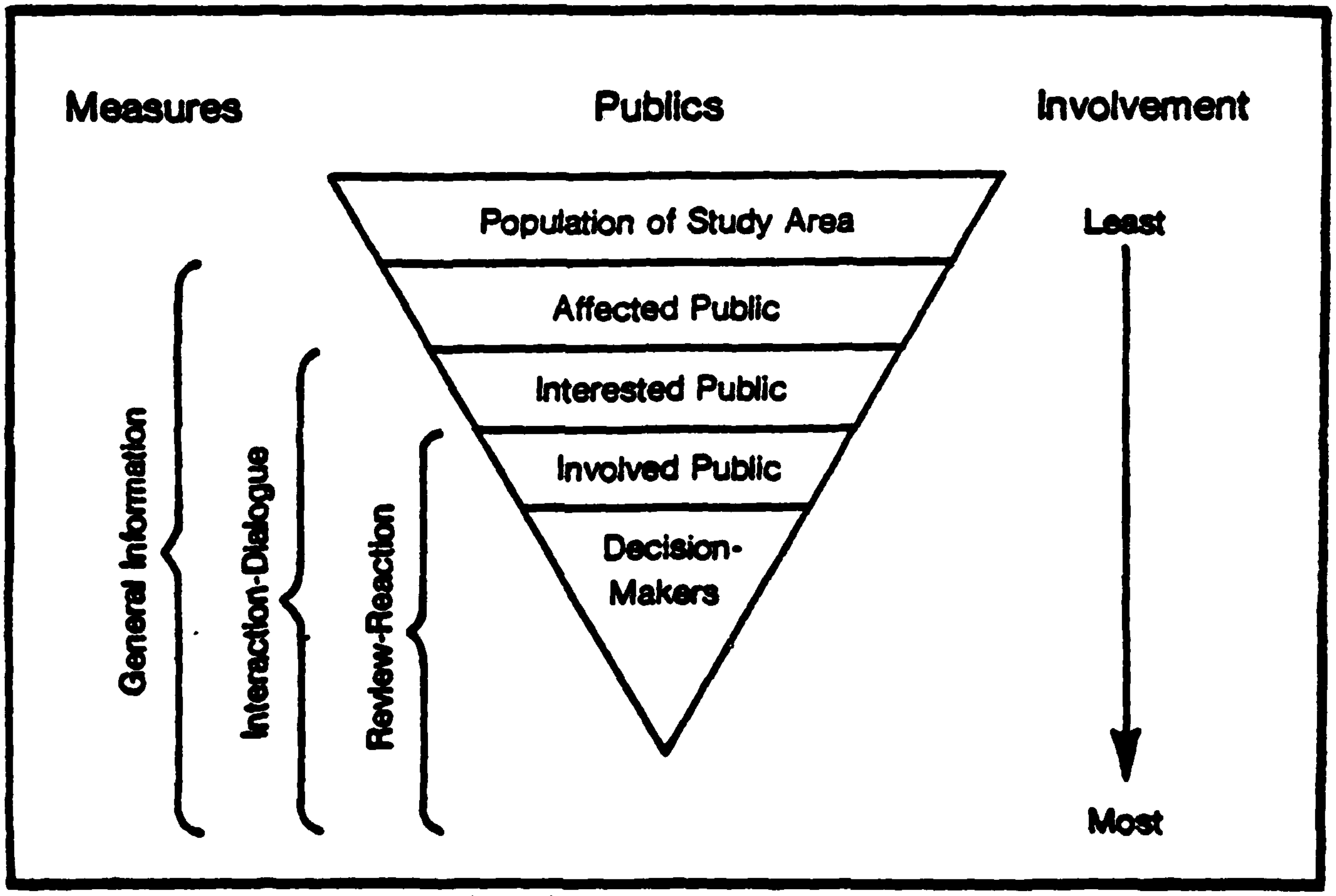


FIGURE B-1 GEARING PUBLIC INVOLVEMENT TO THE PUBLICS

GENERAL INFORMATION

The objective of this measure was to distribute information about study progress and results to as many people as possible. Usually, it provided for only one-way communication with the public. Mechanisms such as newsletters, newspaper articles, special publications, public displays, press releases, and announcements through the media were used to reach most levels of the public.

INTERACTION-DIALOGUE

Interaction-dialogue provided for a two-way communication between the planners and the public. It required a certain amount of involvement by the interested public to obtain a better knowledge of the planning process, as well as a certain amount of involvement by the planners to find out public needs and desires. Interaction-dialogue mechanisms such as workshops, planned educational programs, speeches to organized groups, interviews and tours of the hydraulic model were techniques that were employed to reach those who were either interested, involved, or were decision-makers.

REVIEW-REACTION

Review-reaction was used to obtain feedback from those who were most directly involved with the study. Special committees or advisory groups were formed to accomplish this purpose. Committee meetings, formal public meetings, progress reports, interim reports, and draft and final reports were used to garner the important opinions and values of the involved public and the decision-makers. Figure B-2 depicts the approach that was used in the public involvement process.

THE PROGRAM AND ITS RELATIONSHIP TO THE PLANNING PROCESS

The planning process employed in this study followed Corps of Engineer's guidelines for implementing the Water Resources Council's Principles and Guidelines for Planning Water and Related Land Resources. The planning process consists of a series of steps that identifies or responds to problems and opportunities associated with the Federal objective and specific state and local concerns, and culminates in the selection of a recommended plan. The process involves an orderly, systematic approach to making determinations and decisions at each step so that the interested public and decision-makers can be fully aware of the basic assumptions employed, the data and information analyzed, the areas of risk and uncertainty, and the significant implications of each alternative plan.

The planning process consists of the following major steps:

1. Specification of the water and related land resources problems and opportunities (relevant to the planning setting) associated with the Federal objective and specific state and local concerns.

2. Inventory, forecast, and analysis of water and related land resource conditions within the planning area relevant to the identified problems and opportunities.

3. Formulation of alternative plans.

4. Evaluation of the effects of the alternative plans.

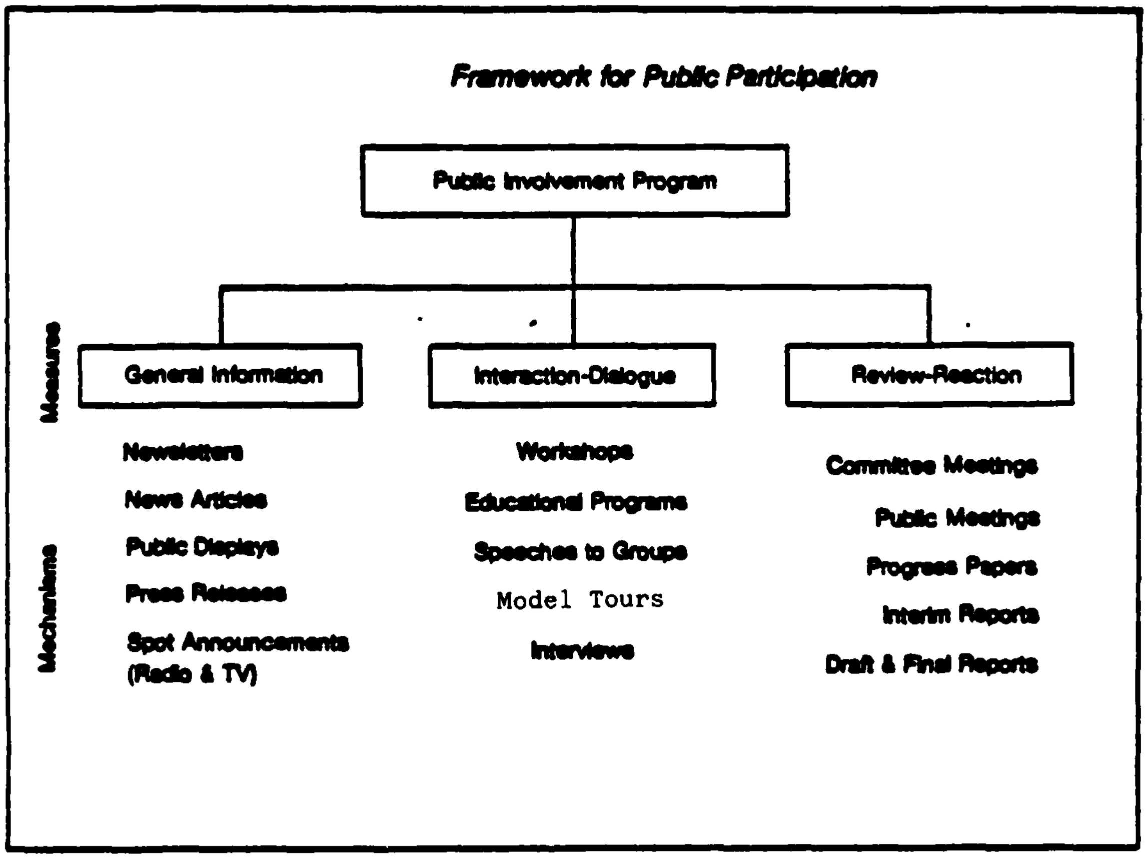


FIGURE B-2 FRAMEWORK FOR PUBLIC PARTICIPATION

5. Comparison of alternative plans.

6. Selection of a recommended plan based upon the comparison of alternative plans.

Plan formulation is a dynamic process with various steps that should be iterated one or more times. This iterative process, which may occur at any step, can sharpen the planning focus or change its emphasis as new data are obtained or as the specification of problems and opportunities changes or becomes more clearly defined.

The public involvement program was conducted throughout the aforementioned planning process with particular elements of the program emphasized as appropriate during the various phases of the study. Following an overview of the study organization and coordination, the scope and results of the program will be discussed as they relate to 1) initial coordination and preparation of the Plan of Study, 2) preparation of the Existing and Future Conditions reports and 3) the final phase of the study. This discussion will fully document all public involvement activities including those related to both the Tidal Flooding Study and the Low Freshwater Inflow Study. Only a cursory discussion of public involvement will be provided in the specific reports on these two studies.

The public involvement program was developed through a series of comprehensive analyses that identified both the interested public and the most cost effective measures that could be employed to achieve the overall public involvement goals. Identifying the interested public was a continuing effort that involved developing mailing lists and identifying those agencies, organizations and individuals interested in learning about and providing input to the study. The analysis of alternative public involvement measures or techniques included a rigorous examination of the advantages and disadvantages, cost, and use-experience. Attachment B-1 is a copy of the most recent of these analyses. Included is a description of the program adopted for the final stages of the study.

STUDY ORGANIZATION AND COORDINATION

Due to the large geographic area comprising the Chesapeake Bay Region and the complex problems which face the estuary, a large number of Federal, state, and local agencies and interstate commissions are involved in various aspects of water resource management in the Region.

Federal concern with natural resources is founded on the fact that these resources form the basis for much of our National wealth and future well-being. The concern for water resources, in particular, is shown by many legislative enactments by the Congress. A continually developing body of law has established varying degrees of regional concern as evidenced by the existence of numerous Federal agencies with priority in such areas as navigation, flood control, drainage, irrigation, recreation, fish and wildlife conservation, water supply, and water quality.

Water resources management is not the exclusive domain of the Federal government. state and local governments also play a vital role. Such governments often have their own management and construction programs, as well as the responsibility to review and comment on proposed Federal projects. They are also an invaluable source of information due to their detailed knowledge of the areas within their jurisdiction. The States usually have one major executive level department responsible for natural resources. However, there are often additional state agencies and commissions in charge

of certain aspects of water resources management outside of this organizational structure.

In addition to the Federal, state and local agencies with water resource responsibilities, there are two inter-state agencies organizations which are directly involved in water resources management in the Chesapeake Bay Region: the Susquehanna River Basin Commission and the Interstate Commission on the Potomac River Basin.

The magnitude and multi-disciplinary nature of the Chesapeake Bay Study required intensive coordination among those agencies and institutions concerned with water resources planning in the Bay Region. This study was conceived as a coordinated partnership between Federal, state, and local agencies and interested scientific institutions. Each involved agency was charged with exercising leadership and providing input in those disciplines in which it has special competence. Toward this end, a special interdisciplinary study group was formed within the Corps of Engineers and several interagency committees were created. These are discussed in the following sections.

CORPS OF ENGINEERS MANAGEMENT

The study was conducted under the general direction of the District Engineer, Baltimore District. Because of the high priority nature of the study, the District Engineer had a high degree of involvement in the coordination of the overall study activities. The routine coordination and study activities were conducted under the supervision of the Chief, Planning Division and the Chief, Chesapeake Bay Study Branch, in order of rank, respectively. The professional staff in the Chesapeake Bay Study Branch either directed or conducted the coordination and public involvement activities.

ADVISORY GROUP

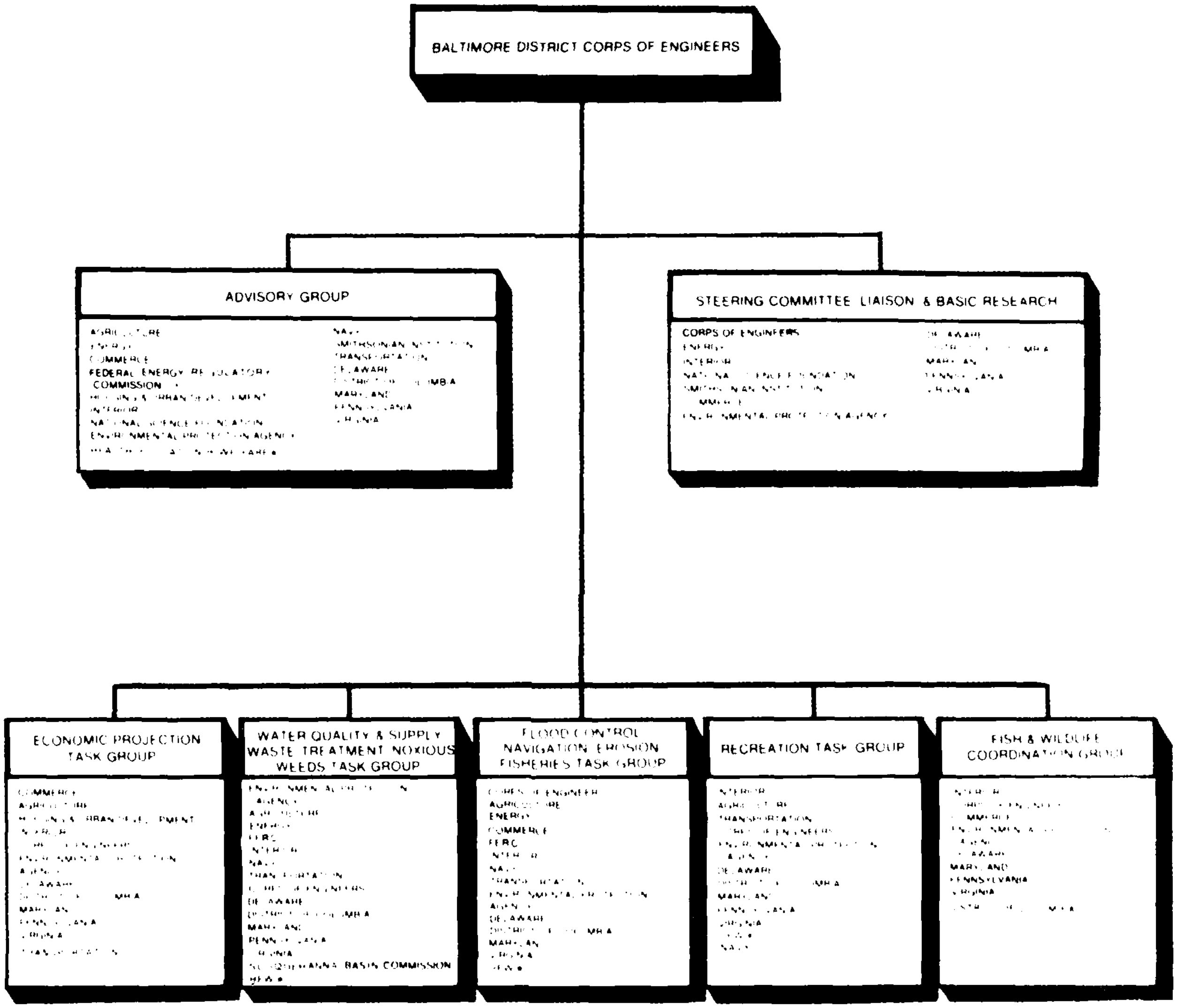
The Advisory Group was established in 1967 as the principal coordinating mechanism for the study. As shown on Figure B-3, the Advisory Group is composed of representatives from 11 Federal agencies, the Commonwealths of Pennsylvania and Virginia, the States of Delaware and Maryland, and the District of Columbia. The individuals serving on the Advisory Group were designated by the heads of their respective Federal agencies or the Governors of the involved states. Table 1 in Attachment B-2 to this supplement lists both the past and present Federal and state representatives on the Advisory Group and their period of service as a member.

Since its establishment, the Advisory Group has advised the District Engineer regarding study policy and has provided general direction under which all study participants have operated. More specifically, the duties of the Advisory Group were established as follows:

a. To advise the District Engineer in the coordination of study efforts.

b. To consider the views of all participants as reported to the Group and make recommendations to the District Engineer.

c. To review reports from all participants.



* NOT REPRESENTED AFTER 1970

FIGURE B-3 ORIGINAL CHESAPEAKE BAY STUDY ORGANIZATION

d. To assist the District Engineer in providing information to the public and encourage participation by the public at hearings and other meetings.

Generally speaking, the Advisory Group was convened whenever it was necessary to coordinate study efforts, to review and comment on study results, and to determine future study direction and activities. Numerous meetings of the Group were held over the course of the study. In addition to these official meetings, continuous coordination among the members was maintained on an individual basis. The District Engineer, Baltimore, and members of his staff also met with one or more agency representatives on an as-needed basis to accomplish the objective of full coordination.

STEERING COMMITTEE

The Steering Committee for Liaison and Basic Research was charged with reviewing the work of the other study task groups in order to bring to their attention and to the attention of the District Engineer any pertinent technological advances in water resource development or the environmental sciences that may not be explicit in the tasks assigned to these groups. In addition, the Steering Committee formulated plans for scientific activities that became a necessary adjunct to the study. The Federal agencies and the states represented on the Steering Committee are shown on Figure B-3. Table 2 in Attachment B-2 lists past and present Steering Committee representatives and their period of service as a member.

ORIGINAL TASK GROUPS

Five task groups were originally established for the Chesapeake Bay Study to include:

a. Economic Projections Task Group

b. Water Quality and Supply, Waste Treatment, and Noxious Weeds Task Groups

c. Flood Control, Navigation, Erosion, and Fisheries Task Group

d. Recreation Task Group

e. Fish and Wildlife Coordination Group

Each task group was concerned with related study categories and functioned as a basic work group. The chairman designated for each task group was from the Federal agency most closely associated with that particular field of study. For example, the Recreation Task Group was chaired by the then Bureau of Outdoor Recreation of the Department of the Interior. A brief description of each task group and its major functions is provided below. The agencies serving on each of these original groups are shown on Figure B-3.

ECONOMIC PROJECTIONS TASK GROUP

The Economic Projections Task Group was responsible for establishing the Chesapeake Bay Economic Study Area which consists of those Standard Metropolitan Statistical Areas (SMSA's) and non-SMSA's adjacent to the Bay and its tidal tributaries or which exert a major influence on Chesapeake Bay. The task group was also responsible for determining the scope and type of projections of income, population, and employment to be prepared for the study. In addition, the group was assigned the task of making

economic evaluations of various proposed solutions to priority problems. This task group was chaired by a representative from the Bureau of Economic Analysis, U.S. Department of Commerce.

WATER QUALITY AND SUPPLY WASTE TREATMENT, AND NOXIOUS WEEDS TASK GROUP

As outlined in the Plan of Study prepared in 1970, the duties of the Water Quality and Supply, Waste Treatment, and Noxious Weeds Task Group included the development of a water quality plan for the maintenance or enhancement of the water quality of Chesapeake Bay. Subsequent to this, the 92nd Congress, 2nd Session, enacted the Federal Water Pollution Control Act Amendments of 1972. This legislation provided that the Environmental Protection Agency assist the state and other local governmental entities in the development and implementation of area-wide wastewater treatment management plans and practices which would achieve the goals of the act. The passage of this act had a marked influence upon the Chesapeake Bay Study as it provided for the accomplishment of much of the water quality and waste treatment work originally envisioned for the Water Quality and Supply, Waste Treatment, and Noxious Weeds Task Group. It was apparent that to continue with this type of work in the Chesapeake Bay Study would not be in the national interest; rather this interest would be better served by integrating the state plans into the ongoing work of the Chesapeake Bay Study Program.

The area-wide wastewater management studies directed by the Federal Water Pollution Control Act Amendments of 1972 were conducted by the involved states. The Environmental Protection Agency established a comprehensive system of communication, coordination, and review. Because of this ongoing program and the already established coordination and review procedures, the water quality and waste treatment related duties of the Water Quality and Supply, Waste Treatment, and Noxious Weeds Task Group was revised and the work was divided into two phases.

Phase I of the Task Group's work was concerned with the integration of the state wastewater management plans into the Chesapeake Bay Study's Future Conditions Report. In this phase, the state wastewater management reports were summarized in accordance with a format established by the Task Group. This summary assessment of the Region's water quality was included in the Future Conditions Report. This completed summary of the water quality served to identify those areas which had high priority problems deserving further study. The second phase of the Task Group's water quality work consisted of determining those high priority problem areas which should be the subject of additional study and hydraulic model testing.

The work involved in the other components of the Task Group mission was conducted as previously agreed upon by the Task Group with the primary responsibility for performing the studies related to water supply and noxious weeds resting with the Corps of Engineers under the direction of the Task Group. The Task Group was chaired by a representative from the Annapolis Field Office of the Environmental Protection Agency.

FLOOD CONTROL, NAVIGATION, EROSION, AND FISHERIES TASK GROUP

As denoted by the name, this Task Group was responsible for study matters related to tidal flooding, shoreline erosion, foreign and domestic waterborne commerce and commercial and sport fisheries. In the course of the study, this group established the purpose and scope of all studies regarding the existing and expected future conditions

relative to the aforementioned resource categories. All portions of both the Existing Conditions Report and the Future Conditions Report dealing with these categories were prepared and reviewed by this group. This Task Group identified high priority problems relative to flooding, navigation, erosion and fisheries, that should be addressed under the Chesapeake Bay Study. The Group was chaired by a representative from the Baltimore District, Corps of Engineers.

RECREATION TASK GROUP

This Task Group was responsible for defining, conducting, and reviewing study efforts relative to the existing and future use of the recreation resources within the Study Area. This group, was chaired by a representative from the Northeast Regional Office of the then Bureau of Outdoor Recreation.

FISH AND WILDLIFE COORDINATION GROUP

This Task Group provided the mechanism for coordination between all Federal and state fish and wildlife agencies. Its primary task or responsibility was to collect, develop, refine, and disseminate data and views related to the fish and wildlife resources of the study area. The Group was chaired by a representative from the Northeast Regional Office of the U.S. Fish and Wildlife Service.

REORGANIZATION OF THE TASK GROUPS

At a January 1980 meeting of the Advisory Group, a discussion was held concerning the five original task groups and the role that they would have in the final phase of the study. Although these groups had served well during the first two phases of the study, it had become apparent that a reorganization was desirable. It was agreed that the groups, as organized along "resource category" lines, would have little meaning for the final study phase and that the work could best be accomplished by groups organized along specific study lines. It was therefore recommended by the Advisory Group, and so adopted by the Corps, that the five original task groups be replaced by two new groups - the Tidal Flooding Task Group and the Freshwater Inflow Task Group.

The Tidal Flooding Task Group provided input to the Tidal Flooding Study and the Freshwater Inflow Group was responsible for the Low Freshwater Inflow Study. However, because the study completion date was advanced over 2 years, the Freshwater Inflow Group never met. The responsibilities of both the Advisory Group and the Steering Committee remained as discussed above. The revised study organization is shown on Figure B-4.

STUDY COORDINATION

The specific tasks or responsibilities of the Advisory Group, Steering Committee, and Task Groups, as outlined in the preceding section, were all part of the overall study coordination and review process. As characterized in Figure B-5, coordination and review was an iterative process that flowed between the District Engineer, Baltimore, and the various elements of the study organization.

The District Engineer, who was responsible for the management of the study, established overall study goals and objectives based on the study authority, budgetary limitations, and advice from the Advisory Group and Steering Committee. The Advisory Group and Steering Committee also suggested the overall studies that should be conducted by the

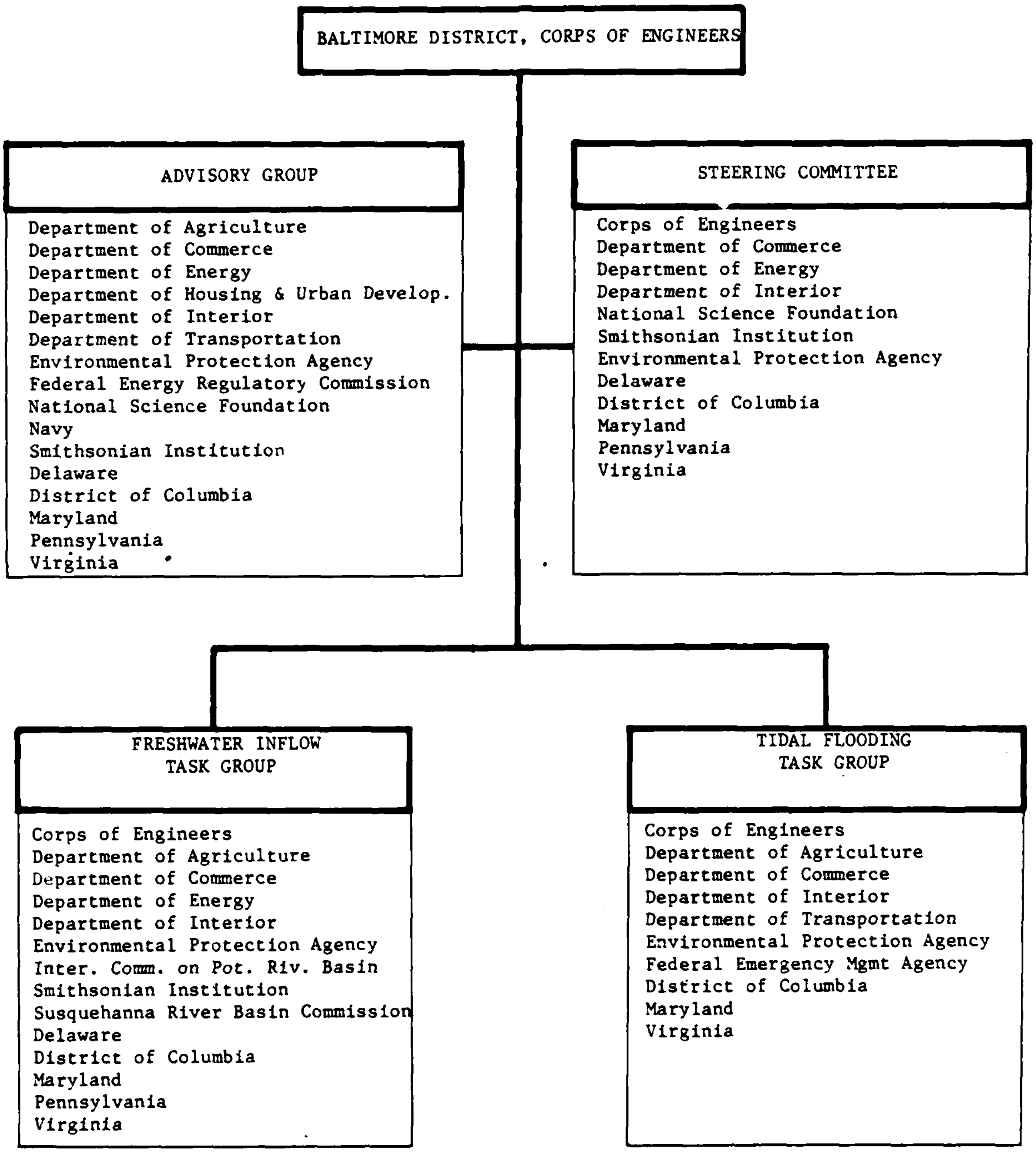


FIGURE. B-4 REVISED CHESAPEAKE BAY STUDY ORGANIZATION

CHESAPEAKE BAY STUDY

COORDINATION AND REVIEW PROCESS

DISTRICT ENGINEER
BALTIMORE DISTRICT

(1) Provides overall goals
(2) Requests advice
(3) Conducts final review
(4) Makes recommendations
(5) Publishes and distributes reports

ADVISORY GROUP

(1) Provides policy guidance
(2) Suggests studies to be conducted
(3) Reviews work of Task Groups

STEERING COMMITTEE

(1) Provides technical guidance
(2) Suggests studies to be conducted
(3) Reviews work of Task Groups

TASK GROUPS

(1) Formulate detailed work plans
(2) Assign work to members
(3) Review work conducted by members

TASK GROUP
MEMBERS

(1) Accomplish assigned work
(2) Review work of other members

FIGURE B-5

Task Groups in order to meet the objectives that were established for the study. The Task Groups were charged with formulating the specific study work plans for those resource categories that were within their area of responsibility. The specific work plans were then assigned to the appropriate Task Group members for accomplishment of the required work.

Following the completion of an assigned work package by a Task Group member, the review process began with all members of the Task Group reviewing the completed work. If the work was considered satisfactory, the report was forwarded to the Advisory Group and Steering Committee for review. It should be noted that if in the course of the review process the report or work was found to be unsatisfactory, the necessary actions were taken to resolve problems. Following the review within the study organization, the final product was forwarded to the District Engineer for final review and further action. Further action consisted of proceeding to the next phase of the study and/or submitting a final report on the findings of the study.

It was through the above coordination and review process that all reports to include the Plan of Study, the Existing Conditions Report, the Impact of Tropical Storm Agnes on Chesapeake Bay, the Future Conditions Reports and this the final report of the study have been prepared and reviewed.

It should be noted that public input was also an integral part of the aforementioned coordination and review process. Through public meetings, citizen group reviews, and other measures, the viewpoints and concerns of the public were identified and the findings were incorporated into the above mentioned reports.

HISTORY OF THE STUDY AND COORDINATION ACTIVITIES

The following paragraphs provide an overview of both the history of the study and the most significant public involvement activities that were conducted over the course of it. The discussion addresses the three phases and/or time periods of the study. The initial phase is defined as the time period from study authorization through approval of the Plan of Study (June 1970). The existing and future condition phase covers the period from the Plan of Study to the publication of the Revised Plan of Study in 1978. Lastly, the detailed study phase covers the period from 1978 to completion of this final report. Included as Attachment B-3 to this supplement is a chronological listing of the most significant public involvement activities conducted over the course of the study. Also included is Plate B-1 which is a sequence diagram showing the most significant study and public involvement activities for the study. Pertinent correspondence for all study phases is included as Attachment B-4.

INITIAL STUDY PHASE

The need for a complete and comprehensive investigation of the Chesapeake Bay area had long been recognized. The regional concept of developing the Nation's water resources was evolving. In terms of Chesapeake Bay, a first step toward what might be considered a system analysis was the Chesapeake Bay Fishing Harbor Economics Study, Maryland and Virginia. This study provided, for the first time, a broad overview of the commercial fishing industry and a firm and consistent basis for the comparison of primary fishing benefits among harbors throughout the Bay area.

In 1961, in response to the recommendation of the Senate Select Committee on National Water Resources that a program be formulated to meet the Nation's water resources needs, the District Engineer, Baltimore District, prepared a pamphlet concerning the Chesapeake Bay area entitled An appraisal of Water Resource Needs Projected to the Year 2060. In the spirit of the Senate Committee's directive, this pamphlet recommended that a cooperative study of Chesapeake Bay be made by the Federal and state agencies concerned with the Bay resource.

In the same year, a basin plan for Chesapeake Bay (Basin Plan, Chesapeake Bay) was prepared by the Baltimore District in cooperation with the Norfolk District and in compliance with instructions from the Office, Chief of Engineers. The plan was based on readily available information and although it was the first attempt at bringing together comprehensive information on the Bay's resources, it was only a very superficial analysis.

Based on the two Corps reports mentioned above and similar studies and analyses conducted by other agencies, it was recognized that with rapidly increasing population and its attendant demands, the resources of the area were receiving pressures which could only be expected to increase in the years ahead. Thus, water resources managers and scientists in the Bay Region felt that a comprehensive study of the Bay and its resources was required in order to develop a Bay-wide management plan.

During this same period, certain Congressional representatives with districts within the Bay Region were expressing interest in a comprehensive Bay study and the construction of a hydraulic model of the Chesapeake Bay similar to the San Francisco Bay and the Mississippi River basin models. It was envisioned that such a model would be used as part of the study decision making process. On 23 February 1965, a bill was introducted by Congressman Hervey G. Machen of Maryland to authorize the Secretary of the Army to *conduct a complete investigation* and study of water utilization and control of the Chesapeake Bay Basin. To carry out this investigation, a hydraulic model of the Chesapeake Bay Basin and an associated technical center were to be constructed. Shortly after introduction of this bill, three other nearly identical bills were introduced by Congressmen Thomas N. Downing of Virginia and Rogers C. B. Morton and George H. Fallon of Maryland.

In July 1965, the Senate version of the River and Harbors Act of 1965 was introduced. It also included a section authorizing a comprehensive Bay study that was very similar to that proposed in the aforementioned House bills. Following some changes, the authority for the study was provided in Section 312 of the River and Harbor Act of 1965 signed by the President on 27 October 1965.

Although the Chesapeake Bay Region lies within three Engineer Districts, the Baltimore Norfolk, and Philadelphia Districts, the study was formally assigned to the Baltimore District Engineer on 3 December 1965. In November 1966, the Baltimore District received the initial funding for the Chesapeake Bay Study. It was at this time that broad study concepts were first developed, advanced planning to define the scope of the authorized model and technical center was initiated, and model site investigation was begun.

In February 1967, the Division Engineer of the North Atlantic Division, in the interest of setting up a Chesapeake Bay Study Advisory Group, invited appropriate Secretaries at the Federal Cabinet level along with the District of Columbia and the Governors of Maryland, Virginia, Delaware, and Pennsylvania to designate representatives to work closely with the District Engineer, Baltimore District, on the overall study goals and objectives and to serve as the chief coordinating mechanism for the study. By September

of 1967, the 13 original members of the Advisory Group had been appointed and the first meeting of that Group was held to discuss study objectives and how related tasks might best be assigned and accomplished. Since the Advisory Group was first established in 1967, there have been numerous changes in both the agencies represented on the Group and the representatives themselves as noted in Attachment B-2.

In March 1968, a Steering Committee and Five Task groups were established and initial meetings were held to discuss the scope of the study and identify the initial work to be accomplished by each of the Task Groups.

In addition to establishing the above groups as a mechanism for obtaining input from other Federal and state agencies and the scientific community, a series of public meetings was held in November and December 1967 to obtain public input. The meetings were held in Baltimore and Salisbury, Maryland, and Newport News, Virginia, to inform the public of the initiation of the study and to obtain their views on problems in the Bay Region.

With regard to the hydraulic model during this early stage of the study, staff from the Baltimore District Office first visited the U.S. Army Engineer Waterways Experiment Station (WES) in February 1967 to determine the support which WES could provide in the design, construction, and adjustment or verification of the model. As a result of the February 1967 meeting, it was agreed that WES would provide design, construction, and operation support for the Bay model.

At approximately the same time, a meeting was held in the Baltimore District with representatives from various elements of the Corps including the Office, Chief of Engineers (OCE), WES, the Coastal Engineering Research Center (CERC), and the North Atlantic Division and the Norfolk District of the Corps of Engineers. Also in attendance were those Federal and state agencies involved in research, regulation, and/or management of the Bay's water and related land resources. The purpose of the meeting was to discuss the problems facing the Bay which might be solved by the hydraulic model.

One of the important decisions to be made early in the study was model site selection. A consultant was hired to conduct a detailed siting study and three sites were recommended in the consultant report submitted in October 1967. In November 1967, the Governor of the State of Maryland formally offered 65 acres of land at Matapeake, Maryland on Kent Island for the model. The offer was accepted by the Baltimore District in December 1967 and title transfer occurred in January 1971.

In the spring of 1968, during its hearings on the appropriations bill for Fiscal Year 1967, the Committee on Appropriations of the U.S. House of Representatives requested that the Corps of Engineers review the scope and cost of the Chesapeake Bay Study program and provide a report on the findings to the Committee. The report, which was formally submitted to the Committee in April 1969, found that the total cost of a study program responsive to the enabling legislation would be approximately $15 million. Subsequently, the River Basin Monetary Authorization Act of 1970, which was passed on 19 June 1970, increased the study authorization from $6 million to $15 million.

The first major public document of the Bay study program was the Chesapeake Bay Plan of Study which was published in June 1970. The Plan of Study, which was reviewed and coordinated with the study organization, outlined the scope of the study, the Study Area and objectives, and how the study was to be conducted and coordinated.

The most important public involvement activities in the first phase of the study were the formation of the study organization; the holding of a series of public meetings; and the preparation, review and coordination of the Plan of Study. The public involvement activities, particular the coordination with the study organization, were very important in shaping the overall scope and direction of the study.

EXISTING AND FUTURE CONDITIONS PHASE

With the Plan of Study serving as the planning guide, work proceeded on the program in two primary areas—the comprehensive resource study and the hydraulic model. Based on the Plan of Study and the advice of the study organization, it was decided that the resource study portion of the Chesapeake Bay Study would be conducted in several phases. Each phase of the study would culminate with the publication of a milestone report that would present the findings of the study to that point. These milestone reports would provide all who are concerned with the management of the Bay a better understanding of the problems outside their own activities and also provide baseline data and a starting point for the next phase of the study.

In the fall of 1971, Congress requested the Corps of Engineers to reanalyze the Chesapeake Bay Study program with a view toward reducing its overall cost. In February 1972, a document was forwarded to Congress which indicated that the minimum cost of the program at November 1971 price levels would be $15,000,000. This, in effect, reduced the financial resources available to the study by an amount equal to price escalation between July 1969 and November 1971. In order to achieve this, it was necessary to make numerous reductions in the scope of the resources study and model facilities including the deletion of the technical center.

Based on a series of Advisory Group and Task Group meetings held in 1971, it was decided that the first phase of the study would result in an Existing Conditions Report that described the existing physical, biological, economic, and social conditions of the Bay and its resources. The report would also identify existing resource problems and conflicts and the various resource management programs and responsibilities. The Chesapeake Bay Existing Conditions Report was published in December 1973. This seven volume report presented in one document a comprehensive and detailed picture of Chesapeake Bay and its resources and marked the conclusion of the inventory phase of the study.

Following completion of the Existing Conditions Report, work was started on the future projections phase of the study. In this phase, the projections were made of the future demands to be placed on the Bay and its resources and resource problems and conflicts were identified. The work was initiated in 1974 and the results were presented in the Chesapeake Bay Future Conditions Report.

It should be noted that prior to the completion of the Future Conditions Report, a series of public meetings was held in June 1976 in Williamsburg, Virginia, and Annapolis and Cambridge, Maryland. The purpose of the meetings was to inform the public regarding the progress to date on the overall study program; to present the findings of the Future Conditions Report; and to solicit the public's comments, views, and perceptions of the Bay's problems and needs.

In June 1972, while work was underway on the Existing Conditions Report, the Chesapeake Bay Basin was subjected to one of the most devastating storms the Region has ever witnessed—Tropical Storm Agnes. The massive amounts of freshwater, sediment, and other pollutants that entered the Bay as a result of this storm caused

considerable environmental and economic damage to it. As a result of the damage and concern as to the long-term effects of the storm on the Bay, the Supplemental Appropriations Act of 1973 included $275,000 for a special study of the effects of the storm on the Bay. The Act was signed by the President in October 1972 and the study was subsequently assigned to the Baltimore District, Corps of Engineers, where it was to be conducted concurrently with the Chesapeake Bay Study. The following objectives were established for the special Agnes Study:

a. Determine and document the effects of the storm on the Chesapeake Bay estuarine system.

b. Locate any changes in the bottom geometry of the Bay and its tributary arms and determine if these changes were of sufficient magnitude to warrant a change in the design of the hydraulic model.

In pursuit of the first objective, a contract was let in June 1973, to determine the physical, biological, economic, and public health impacts of the storm on the Bay system. In order to determine if bottom geometry changes warranted a change in the hydraulic model design, hydrographic surveys were made in several areas to determine the extent of the changes. Based on the results of the contractual work, a report titled Impact of Tropical Storm Agnes on Chesapeake Bay was prepared, reviewed by the study organization, and published in October 1975.

Concurrent with the conduct of the resource study, work also proceeded on the hydraulic model. Based on a series of meetings held in 1967 and 1968, a prototype data collection program for the model was formulated. In order to verify the model's operating similarity to the Bay (prototype) system, tidal elevations, tidal current velocities, and salinities had to be measured at many locations in the prototype. These prototype data were used as a basis for both model adjustment and final verification that model hydraulic and salinity phenomena are in acceptable agreement with those of the prototype. In June 1970, contracts and interagency agreements were awarded for the collection of salinity, tidal and velocity data. By the summer of 1974, all of the prototype data required for the adjustment and verification of the model had been collected.

Because of the hydraulic model's small scale and the resultant precision required in collecting data, the model had to be protected from wind, rain, and windborne debris. The detailed design and the preparation of the plans and specifications for a shelter to house the model were completed in 1972. Subsequently, a contract for the construction of the shelter was awarded in February 1973 and a formal groundbreaking ceremony was held in June 1973.

In April 1974, as a result of more refined estimates, actual construction bid experience and substantial overruns on the construction of the shelter for the hydraulic model, the Chesapeake Bay Study program was again reviewed in detail and four options for accommodating the cost increases were evaluated. The final report on this reanalysis recommended that the scope of the resource study portion of the program be reduced as total compensation for the cost increases. In this reanalysis, which was an internal Corps document, it was recognized that there were not sufficient financial resources available within the imposed ceiling to produce a comprehensive management plan for Chesapeake Bay; and it was recommended that the resource study terminate in a final report to Congress on the Bay's present and future water resources problems and needs. Model related work would consist of a one year program oriented to gaining increased

knowledge of the Bay's hydrodynamics and/or providing data needed to solve pressing problems.

Concurrent with the design and construction of the model shelter, the Waterways Experiment Station (WES) was designing the model and the required hydraulic appurtenances. The model design, which included the design and in some cases fabrication of the various elements of the model's hydraulic system and the plotting of approximately 26 miles of templates, was completed in the summer of 1974. Construction of the model was started in October 1974 and the approximately 9 acre model was completed in April 1976. A formal dedication ceremony sponsored by the Commissioners of Queen Anne's County was held on 7 May 1976. This dedication ceremony marked the beginning of an adjustment and verification period that was completed in June 1978.

During the conduct of the studies associated with the projection of the future needs phase of the resource study and in the formulation of the one year program of tests to be conducted on the hydraulic model of Chesapeake Bay, it became apparent that there were many problems in Chesapeake Bay which could be solved only in the context of a hydraulic model studies program far beyond that which could be accomplished in the one year period recommended in the April 1974 reanalysis. It was also apparent that if such a model studies program were undertaken, it should be formulated in the context of a resources study which would provide for the development of a model studies program and which would use the model studies output data as an aid in formulating problem solutions.

In recognition of this need, an internal document entitled "Reanalysis and Revised Scope of Work, Chesapeake Bay Study" was prepared and submitted to Corps higher authority on 14 March 1975. In this report, four alternatives for expanding the resources study and model testing program were presented. It was concluded that continued studies were desirable in order to be responsive to the Congressional authorizing legislation. The recommended program consisted of a 5-year expanded resources study oriented to the formulation of solutions to priority problems. In order to accomplish this, three additional years (total of 4 years) of testing on the Hydraulic Model of Chesapeake Bay would be required. The recommendation for an expanded program was approved and a detailed plan of work for the final study phase was prepared and presented in the Revised Plan of Study published in October 1978.

During the existing and future condition phase of the study, there were a significant number of important public involvement activities. The study organization to include the Advisory Group, Steering Committee and Task Groups, met on numerous occassions to shape the scope and content of the Existing and Future Conditions reports. The study organization also provided valuable advice and support relative to the recommendation for an expanded study in the 1978 Revised Plan of Study. This phase of the study was also marked with a number of special public involvement events related to the model to include the groundbreaking ceremony in 1973 and the dedication ceremony in 1976. The dedication ceremony also marked the start of public tours of the model. The model tours were extremely beneficial in providing the public with an understanding of both the study and the complexities of Chesapeake Bay. The release in April 1973 of a specially prepared film which presented a discussion of the Chesapeake Bay, the study and the hydraulic model also provided a means to reach large numbers of people with general information about the program. The film was shown on local TV and was used over the next several years for literally hundreds of presentations around the Study area.

During this phase of the study, the Citizens Program for Chesapeake Bay, Inc (CPCB) was formed and adopted by the Corps as the study's Citizens Advisory Committee. Members of CPCB reviewed and provided comments on both the Existing and Future Conditions Reports. Prior to publication of the Future Conditions Report, a series of three public meetings was held around the Bay area to present the preliminary findings of that phase of the study and to solicit any additional public comments. Lastly, the first News Circular for the study was published and distributed to a mailing list of nearly 10,000 interested parties. Pertinent correspondence and materials documentary the public involvement activities may be found under Attachment B-4. Copies of all the News Circulars published as part of the study are included as Attachment B-5.

As noted above, the public involvement program was very active during the second phase of the study. A wide range of public involvement measures were employed to both disseminate information and to solicit advice. Further, the measures used were targeted for a wide spectrum of Bay interests from the general public to Bay scientists and state/local officials.

FINAL STUDY PHASE

With the approval in 1978 of the Revised Plan of Study, work proceeded into the final study phase. As recommended, the three high priority areas of study were Tidal Flooding, Low Freshwater Inflow and High Freshwater Inflow.

With regard to the Tidal Flooding Study, detailed flood damage surveys were conducted in 1979 in those flood prone communities selected for detailed study. Following the completion of preliminary alternatives analyses and other environmental and socio-economic studies, a Stage 2 Report was published in August 1980. Based on the Stage 2 findings, it was recommended that more detailed studies of several selected communities and the development of Bay-wide stage-frequency relationships be carried into Stage 3. A Technical Studies Work Plan detailing the stage-frequency related work was prepared and approved. In 1981, work was initiated on the stage-frequency analyses and the supporting Storm Surge Test was conducted on the hydraulic model in 1982. Concurrently, more detailed study was underway for those communities recommended for further examination in the Stage 2 Report.

Work on the Low Freshwater Inflow Study started in 1979. It included defining the economic, environmental and social impacts associated with reduced freshwater inflows and developing a methodology for a detailed assessment of the impacts of reduced flows on Bay biota. The initial hydraulic model test (Problem Identification Test) was completed and the results were used to develop an understanding of the low flow hydrodynamics of the Bay and to define the biota-related impacts.

As the majority of the effort was being placed on the two above mentioned studies, early work on the High Freshwater Inflow Study was limited to a literature search and collection of data needed for environmental, economic and social assessments.

Testing on the hydraulic model was initiated in July 1978 with the Baltimore Harbor Channel Enlargement Test. The Baltimore Harbor Test was followed in turn by the Low Inflow Operational Procedure Test and the Potomac Estuary Test. Major maintenance of the model was performed after the first 8 parts of the Potomac Estuary Test were completed in June 1979. This maintenance took approximately 4 months to accomplish and included substantial modifications to the devices controlling the flow of freshwater into the model. In view of the fact that this work had not been anticipated when the

Revised Plan of Study was prepared, it was necessary to reduce the number of tests to be conducted if the established time frame for completion of the Chesapeake Bay Study was to be met. The Wastewater Dispersion Test for the Environmental Protection Agency was therefore deferred as it did not appear that this agency would be prepared to provide the input data for it until after the completion of the tests specifically required for the Chesapeake Bay Study program.

In the spring of 1980, during the conduct of the second eight parts of the Potomac Estuary Test, it was found that the hydraulic model was not repeating the pretest stability conditions characteristic of those portions of the Potomac Estuary Test previously run. Upon investigating this problem, it was discovered that some of the concrete slabs in the model were visibly heaved as evidenced by differential vertical displacement of adjacent portions of the concrete at the expansion joints. Expansion joint material was tightly compressed in some areas, and on a model-wide basis, sealant material was being extruded from the joints.

An intensive investigation of the problem was initiated in order to ascertain the cause of the heaving and to determine the extent of the damage. The leveling surveys revealed that the model had heaved, in some places, as much as 0.2 feet. The bulk of the concrete movement took place between Kent Island and the model ocean, in the broad expanse of concrete forming the southern portion of Chesapeake Bay. In turn, survey data showed that the northern portion of the model and all the tributary arms on both the Eastern and Western shores remained relatively stable. Approximately 10 percent of the model was found to have had significant uplift. As a result of this analysis, it was concluded that the heaving of the concrete in the model was caused by thermal expansion complicated by an insufficient number of expansion joints in the model to relieve the stress generated in the concrete. A plan for the rehabilitation of the model was developed and approved by the North Atlantic Division. Repair of the model concrete was started in October 1980 and was completed in February 1981. This was followed by a period of adjustment and reverification which was completed in September 1981.

Following verification, the Storm Surge Test was performed for the Tidal Flooding Study. This test consisted of obtaining surface water elevations throughout the Bay resulting from the ocean tide, a surge wave, a combination of the above two, and fluvial discharge. The results of this test were to be used to adjust and calibrate a numerical storm surge model being developed by the Waterways Experiment Station. From October through December 1981, The Norfolk Harbor Channel Deepening Test was performed for (and funded by) the Norfolk District of the Corps. Because of funding constraints, the model was placed in a state of operational readiness for the remainder of Fiscal Year 1982.

During fiscal year 1983, efforts on the resource study were devoted primarily to the Low Freshwater Inflow Study. This consisted of making assessments of the socio-economic and environmental impacts of reduced freshwater inflows on the users of the Bay. Work activities also included formulating preliminary alternative solutions to identified problems and developing a relationship between salinities and freshwater inflows to the Bay using the results of the Problem Identification Test. This relationship was used to assist in determining those inflows needed to mitigate the adverse effects of reduced freshwater inflows.

Funds in Fiscal Year 1983 were not sufficient to allow the conduct of any model tests and the model was therefore maintained in a state of operational readiness. This combined with the period of operational readiness in Fiscal Year 1982 meant that no testing was performed on the model for 21 consecutive months. By maintaining the model during this period, deterioration of the model and its equipment was held to a minimum.

During the development of the Fiscal Year 1984 budget, the decision was made that the Chesapeake Bay Model should be closed in Fiscal Year 1983. It was further decided that by reorienting the study to accommodate the model closing and reducing its scope, the study could be completed by the end of Fiscal Year 1984. Because the facility was closed, the following remaining hydraulic model tests could not be conducted:

The Potomac Estuary Water Supply Test (Last 8 parts)
The High Freshwater Inflow Test
The Low Freshwater Inflow Sensitivity Test
The Low Freshwater Inflow Plan Test

With the decision to close the model in 1983 and complete the study by the end of Fiscal Year 1984, there were a number of significant modifications made to the program.

The original scope of work for the Low Freshwater Inflow Study provided for the formulation of those "schedules" of freshwater inflow to Chesapeake Bay necessary to maintain and enhance socio-economic and environmental values. In order to achieve this, alternative salinity regimes were to be identified based on analyses of environmental and socio-economic impacts. The freshwater inflows required to achieve these salinity levels would then be identified based on results of the hydraulic model tests. Socio-economic and environmental impacts of the upstream measures required to achieve these inflows were also to be considered. Institutional analyses would focus on the arrangements required to implement these plans. The resulting data from these analyses and the hydraulic model would have been used in the selection of the final "schedule" of flows to be recommended for each of the major tributaries. This "schedule" of flows was to be verified through tests on the hydraulic model.

Under the reduced scope, the screening process was not carried as far. The result is an identification of the most promising alternative plans and an estimation of the required freshwater inflows. The hydrologic and hydraulic feasibility of achieving these freshwater inflows is assessed, but, upstream flow modification measures or impacts are not specifically addressed. With the deletion of the Sensitivity and Plan Tests on the model, the results of the Problem Identification Test were the sole basis for determining the salinity-freshwater inflow relationship and for translating desirable salinity levels to freshwater inflow requirements. The final report on the Low Freshwater Inflow Study contains an assessment of the socio-economic and environmental consequences of reduced freshwater inflows to Chesapeake Bay and an identification of the most promising alternative solutions to the problems caused by these flow reductions.

As noted earlier, Stage 2 of the Tidal Flooding Study was completed and the Stage 2 report was submitted in August 1980. All remaining work, as originally formulated, was to be based on the development of a storm surge numerical model which would define the flood-stage-frequency relationship for the Chesapeake Bay. The results of this model would be used in assessing the feasibility of providing structural or nonstructural

protection to floodprone communities. In order to accelerate the completion of the study, however, the storm surge numerical modeling effort was deleted from the program. Therefore, all feasibility analyses were based on existing available flood-stage-frequency information rather than the refined data expected from the numerical modeling effort.

The major effort left on the Tidal Flooding Study consisted of reviewing and revising the Stage 2 report based on updated information when available. The final report of the Tidal Flooding Study provides an analysis of the feasibility of providing structural and nonstructural protection for floodprone communities and recommendations for survey scope authorization studies in those communities where some form of flood protection is found to be economically and environmentally feasible and socially acceptable.

With regard to the High Freshwater Inflow Study, all work on that study was predicated on the availability of data from the hydraulic model tests. Since the model was no longer available and this data cannot be obtained by any known conventional method, the High Freshwater Inflow Study was deleted from the program.

An extensive examination of the potential future uses and/or need for the model was done by a task force established by Congressman Roy Dyson of Maryland. It was found that the model is not required for any further testing; however consideration should be given to maintaining it as a multi-use center. It should be noted that effective August 1984 the State of Maryland has assumed the maintenance on the hydraulic model pending the transfer of the model to the state. The final phase of the study was completed in 1983 and a draft final report was circulated for review in March 1984. Included as Attachment B-5 are copies of the review comments received and the disposition of those comments. Based on the review comments, the report was revised and the final report was published in September 1984.

Public involvement activities during the final phase of the study were similar to those conducted during the first two phases of the program. Advisory Group and Steering Committee meetings were held to seek advice on the conduct and findings of the Tidal Flooding and Low Freshwater Inflow Studies. Three additional News Circulars were published (Attachment B-6) to keep the general public advised of study progress and findings. In cooperation with EPA, the State of Maryland and the Commonwealth of Virginia two large portable displays were prepared in January 1979. These displays consisted of a discussion with appropriate photos and graphics of the Bay related programs of the Corps, EPA and the two states. The displays were circulated throughout the Bay area for exhibit in public buildings, schools, festivals and other appropriate Bay related events. In November 1979, the Corps and the Chesapeake Research Consortium, Inc. jointly sponsored an educational seminar to discuss the Bay and the capabilities and potential uses of the model. The seminar was held at the newly opened visitor center at the hydraulic model and was attended by engineers, scientists and academicians from the Bay area. It should be noted that because of the schedule for completing the study was advanced several years, there was little opportunity for participation by a citizens advisory committee.

Perhaps the most significant public involvement activity of this period was the model tour program. While model tours were actually initiated in 1976, a visitors center was not completed until August 1979. The visitor center facility and the tour provided a complete Chesapeake Bay and hydraulic model experience. The lobby of the visitor center had numerous displays which explained the Bay and the hydraulic model. The

visitor could then enter the auditorium for a 20 minute professionally prepared and narrated slide show which further described the Bay and its problems and the Corps' study and Hydraulic Model. Lastly the visitor received a 30 minute guided tour of the model with an even more detailed discussion of how the model operated and a description of the testing being conducted at that time. Generally speaking, the tours were provided three times a day for the entire period between June 1976 and August 1983. The model was also open on selected weekends for such events as Chesapeake Appreciation Days. During the period the model was open, it is estimated that approximately 200,000 people from every state and numerous foreign countries visited the model and received some appreciation and understanding of the Bay and the Corps program.

The public involvement program was judged to be quite extensive during the final study phase. The model tours and related events were probably the most visible activities; however, the coordination and review work with the study organization and other interested parties was most important in developing the final recommendations of the study.

AN EVALUATION OF THE PUBLIC INVOLVEMENT PROGRAM

A documentation of the public involvement program for the Chesapeake Bay Study would not be complete without an evaluation of the results and/or effectiveness of the program. While a comprehensive, objective assessment is difficult, the following paragraphs provide a general assessment of the program.

As a point of fact, the public involvement program for the Chesapeake Bay Study was probably the most comprehensive and expensive program of its type conducted by the Baltimore District to date. Literally thousands of hours of manpower and hundreds of thousands of dollars were spent in providing information to and seeking input from the public. In total, the expenditure of time and funding appears to have been worthwhile. In particular, the public and special tours of the Chesapeake Bay Hydraulic Model were extremely valuable in educating the public relative to the importance and complexity of Chesapeake Bay. The understand gained from the model tours by both school child and legistator was important to not only the Corps study but the future of Chesapeake Bay as well.

The coordination with the scientific community during the course of this study is also noteworthy. The study and hydraulic model provided a focus which led to improved coordination among those members of the scientific community concerned with the resources of Chesapeake Bay. Many of the analyses conducted as part of this study were considered to be "state-of-the-art" and as such, there was a productive exchange of information and ideas among Corps and non-Corps professionals. While there was certainly not universal agreement on the nature and importance of all of the technical findings, there was a spirit of working toward an overall goal of maintaining or enhancing the Bay's resources.

Unlike most previous studies, the Corps study focused on the total Bay and all of its resources rather than one subestuary of the Maryland or Virginia portion of the Bay. Because of this total resource concept, the coordination aspects of the study supported and, in some cases, fostered an even greater degree of cooperation among the many political subdivisions concerned with the Bay. It is felt that this study made a significant

contribution toward legislative actions relative to management of Bay resources on a Bay-wide basis.

An important factor to be considered in evaluating the public involvement program is the effectiveness of the program in disseminating information to the general public. In addition to the model tours mentioned earlier, the news circulars, public presentations, news releases, and reports were successful in educating an interested public. To say that all of the millions of people within the Bay area are fully attuned to the study and its findings is an overstatement; however, there is a strong indication that the general public does have a better understanding of the Bay and its problems. The level of understanding is attributable to the media coverage of Bay related problems and activities; the studies and public involvement activities of others such as the EPA Chesapeake Bay Study; and the Corps' study efforts.

Lastly, the study organization as used for this study proved to be a most effective means for the preparation, review and coordination of study efforts. In a complex, multidisciplinary study that required considerable input from agencies outside the Corps, the concept of a layered study organization composed of an overall policy advisory group, a technical steering committee and working task groups worked well. The documentation referenced earlier indicates that the various study committees met relatively frequently throughout the course of the study and that the advice and/or input gained was most valuable to the study effort.

ATTACHMENT B-1

CHESAPEAKE BAY STUDY

PUBLIC INVOLVEMENT PROGRAM ANALYSIS

CHESAPEAKE BAY STUDY
PUBLIC INVOLVEMENT PROGRAM ANALYSIS

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ALTERNATIVE PUBLIC INVOLVEMENT MEASURES

In order to determine which public involvement techniques have the most impact on Bay-related publics, it was necessary to conduct extensive research using all available public involvement manuals, studies, and other publications. In addition, interviews with public involvement specialists provided insight as to which means and mechanisms have been used effectively in other public participation programs. It was also important to draw upon past public involvement experience during the conduct of the Chesapeake Bay Study to determine effective ways of involving the public.

The following short summaries provide information on those public involvement techniques which appear to be the most beneficial in water resources planning. They also constitute the most frequently used techniques. A bibliography of those reports and other materials used to further define the Bay study's public involvement program is attached.

a. Public Meetings.

The purpose of the public meeting is to provide for the exchange of information between the public and the planning agencies. It gives the public an opportunity to learn what the agency is doing and to allow the agency to hear the public's reaction to work accomplished to date. Public meetings are commonly broken down into several phases. The first, the initial meeting, is to let citizens known a study has begun and what is involved. The second, the formulation meeting, presents alternatives which were developed during study formulation. The third, the last stage, presents the most promising alternatives and reasons for selection. The fourth phase is the special meeting, and its purpose is to fulfill some special need which has arisen during the project (the second series of public meetings held for the Chesapeake Bay Study was of this type - conducted to inform the public of the findings of the future conditions phase of the study).

(1) Composition - As the name implies, the public meeting is geared for attendance by the general public. Public notices are distributed to Federal, state, and county officials; representatives of quasi-public agencies; special interest groups; news media; as well as interested individuals. The meetings are generally held by the planning agency in the evening hours in a public building centrally located in the area of public interest. All testimony is recorded and an official transcript is prepared.

1/This is a copy of a staff paper prepared in 1979. It was used as the basis for formulating the public participation program for the final phase of the Chesapeake Bay Study.

(2) Objectives - Some of the major objectives of a public meeting include:

- To make the planning process more meaningful to both the public and the planning agencies.
- To provide a good method for the planning agencies to furnish information to the public.
- To legitimize planning decisions reached in planning workshops.

(3) Advantages and Disadvantages - The advantages of a public meeting are as follows:

- public meetings allow for the agency to receive public reactions while the planning work is still underway
- because they are less formal than a public hearing, they may be somewhat less intimidating to the average citizen
- public meetings provide opportunities for the agency to inform the public, thereby providing for public reaction to the study's progress
- meetings allow the agency to reach a large number of people with information at a single time

The public meeting has certain disadvantages, however. These include:

- large meetings do not allow for interaction between groups and, as a result, do not provide opportunities for discussion, negotiation, or dialogue between opposing points of view.
- large meetings may encourage polarization of positions and allow dominance by vocal minorities
- public meetings may not be well attended unless issues are controversial
- without skillful leadership, meetings may result in a negative reaction towards the agency and its programs

(4) User Experience - Two series of public meetings concerning the Bay study have been held. One series took place at the initiation of the study and the other toward the end of the second or future projections phase of the study. Public notices were distributed to Federal, state, and county officials; representatives of quasi-public agencies; special interest groups; news media; as well as interested individuals. The format for these two series of meetings has been for the Corps to open the meeting with a brief description of the study and then to allow anyone who desires to ask questions and to voice their opinions. The pertinent information that is derived at the meeting is incorporated into the study.

In 1967, during the first full year of actual work on the Chesapeake Bay Study program, a series of three public meetings were held. The purpose of these initial public meetings was to inform the public of the initiation of the study program and to solicit their views as to what direction the study should take. As a convenience to the public, meetings were held at three different locations within the Region. A total of 110 persons attended the initial public meetings, including representatives from Congressional, Federal, state, local, and private interests. All speakers voiced support for the study, citing the need for comprehensive planning for the use of Chesapeake Bay's water resources.

The more recent series of public meetings was held in June 1976. The purpose of these meetings was to inform the public regarding progress to date on the overall program; to present findings in terms of needs and problem areas as identified in the Future Conditions Report; and to solicit the public's comments, views, and perceptions of problems, needs, and related impacts. As was the case with the first series of public meetings, centrally located cities were selected as sites. Attendance totaled approximately 250 people at this series of meetings.

Speakers at this latest series of meetings asked questions concerning specific findings of the Future Conditions Report, the direction of the next phase of the study, and the types of tests which can and will be performed on the hydraulic model. Great concern was voiced over the continuing degradation of the Bay's land and water resources. There was also general concern expressed on lack of coordination between Federal and state agencies and private groups conducting research on Chesapeake Bay. As with the first series of meetings, the majority of the speakers voiced continued support for the Corps' Chesapeake Bay Study program.

Public meetings are a very popular means of involving the public in the planning process and are consequently sponsored by most organizations (The Corps is required to hold a certain number of public meetings during the course of a study). The Citizens Program for Chesapeake Bay (CPCB) has held numerous public meetings dealing with EPA's Chesapeake Bay Program. These meetings are advertised by circulating large numbers of "Fliers" announcing time, place, and purpose of meeting. Mass distribution is made to the concerned organizations and groups who in turn further distribute these fliers to their members. CPCB has not always had good attendance at these meetings due to the fact that the meetings have not been advertised far enough in advance. They have all served a useful purpose, however, by building an important rapport with interested members of the public who were in attendance.

b. Public Hearings. (public inquiries)

The purpose of the public hearing is to allow the public a chance to present testimony for or against a proposed program or project.

(1) Composition - Public hearings are characterized by legalistic procedures in which an agency hears highly formal testimony from groups of individuals. The attendance may range in number from 50 to 1,000. As in the case of a public meeting, all testimony is recorded and an official transcript is prepared.

(2) Objective - The chief objective of a public hearing is for the compilation of testimony to justify a decision regarding a project or program.

(3) Advantages and Disadvantages - Because of their formality, experts generally agree that public hearings, unless required by law, should be avoided. Other

techniques such as public meetings or workshops can be effectively substituted. About the only advantages of a public hearing are that they are generally accepted by the public as an integral part of the planning process because of their long history as a participatory technique; and they do assure citizens an opportunity to challenge the actions of the public agency. Their disadvantages far outweigh their advantages, however. These include:

- the legalistic proceedings of the hearing tend to intimidate all but the best organized groups

- the nature of a hearing encourages highly emotional presentations and polarization of positions so that disagreements within a community may actually increase

- the public may tend to feel that important decisions have already been made and that the hearing is merely a formality

- public hearings do not allow for discussion, negotiation, or dialogue between opposing points of view

(4) User Experience - Probably because of their formality and lack of public acceptance, there have been no public hearings held during the Chesapeake Bay Study. Other organizations have held what they refer to as public hearings although these "sessions" appear to have been less formal than a public hearing in the strict sense. Thus, the public hearings which have been held by the Virginia Coastal Resources Management Program and the State Water Control Board (208 Program) may be more characteristic of public meetings than public hearings.

(c) Workshops.

Workshops are working sessions in which agency staff and citizens work together toward some specific planning objective. They offer an opportunity for planning agencies to include community interest groups in the process at a "policy-making level." Workshops may be conducted for a variety of purposes including problem identification, development of alternatives, evaluation of alternatives, projecting future trends, and negotiation regarding alternatives. Because workshops allow for intense interaction, they should be carefully planned and conducted by a skilled meeting leader. Emphasis should be upon mutual problem solving rather than the taking of fixed positions.

(1) Composition - While the planner workshops are generally open to the public, it is most important that community leaders, representatives or organized interests and other citizens interested in water resources planning be represented. Leadership for the workshop should be provided by strong, knowledgeable individuals, with planners providing technical support and monitoring the discussion.

(2) Objectives - The workshop has a number of objectives including the following:

- To provide citizen involvement in the planning process which cannot be effectively achieved through other participation activities

- To lay groundwork for continuous feedback from local interests in developing and assessing planning alternatives

- To obtain a degree of consensus on planning decisions

- To gain an expression of local needs, desires, and goals from local interests.

(3) Advantages and Disadvantages - the advantages of workshops include:

- they allow for extensive interaction, discussion, and negotiation among agency staff, and various publics

- they allow for the development of concrete "products" which contribute to the progress of the study

- workshops allow for participation by all in attendance and reduce opportunities for dominant individuals to control the meeting

- by working together to produce a "product," relationships are formed between publics and agency staff

Two disadvantages of workshops exist. First, because attendance at workshops is limited, there is some danger that certain individuals or groups may feel excluded. Second, without careful planning and skilled leadership, workshops can be a frustrating experience brought about largely because certain individuals may dominate to the exclusion of others or because discussion may "get off" onto some irrelevant subject.

(4) User Experience - The Corps frequently sponsors public workshops in connection with planning investigations. For example, a series of 16 public workshops was recently held in the Potomac River Basin to obtain local opinion on water supply in the Metropolitan Washington Area, to inform the public about the Corps' Metropolitan Washington Water Supply Study, and to address the public's concerns over water-related issues. The workshops were co-sponsored by two groups through separate contract arrangements: the Interstate Commission on the Potomac River Basin and the Metropolitan Washington Council of Governments.

Generally, it was believed that these workshops served a useful purpose by facilitating discussion among the Corps, representatives of planning and utility agencies and the general public. Although the workshops represented only a small percentage of the "publics" in the basin, they served several educational functions including:

- providing the general public with information on water supply planning

- allowing citizens the opportunity to express their opinions on water supply-related issues

The workshops were held throughout the Washington Metropolitan Area. Various civic, environmental, and business organizations were invited to serve as "participating organizations" in the meeting. Also invited were local legislators, mayors, county executives, and planning agency staff. The general public was invited, although few "walk-in" citizens were present. Attendance at each meeting averaged around forty.

The Virginia Coastal Resources Management (CRM) Program has sponsored a number of public workshops in the tidewater portion of Virginia. A large 2-day workshop was held in Hampton, Virginia in June 1977 in order to solicit from the public specific recommendations for the management of Virginia's coastal land and water resources.

In addition to the large Hampton workshop, the Virginia CRM program has cosponsored a number of smaller public workshops together with certain planning district commissions within the coastal zone. While the Hampton workshop was the most productive, the small workshops helped establish good working relationships with community groups. The Maryland Coastal Zone Management Program has also sponsored a number of public workshops, primarily during the early program formulation stage.

Workshops can be very time consuming and dissatisfaction may occur if the participants feel their views are not being properly considered. While workshops can be useful in eliciting public response, they are very difficult to "carry-off" effectively. In addition, they require a great deal of skill to organize and conduct. One of the most difficult tasks is to convey to the participants that their input will be considered in decision making, but that the input will not be blindly or automatically incorporated in the planning process.

d. Publications.

Publications are one of the most effective means of disseminating information to the public concerning study objectives and outputs, history, current status of the study, and other meaningful data.

(1) Composition - Some of the publications best suited to inform the public of and about the study include:

(a) Press releases are issued to the mass media at times when it is essential for information to be disseminated quickly and concisely. Such developments as authorization of the study, completion of study reports, study findings, and model test results are worthy of press releases. In order to make a story newsworthy, there are certain requirements to be followed. The story should show the importance of the study. It should be timely and appeal to the emotions in order to appeal to human interest. If a story is carried by the newspaper, a large number of people have been reached with a minimum cost and expenditure of effort.

(b) Information brochures are distributed at meetings and exhibits or mailed to various groups and individuals in order to provide information on a specific aspect of a study. Normally, brochures provide more information on the study than press releases, but their distribution is much less extensive.

(c) News circulars, or information bulletins, are distributed on a more regular basis than information brochures. They usually contain information summarizing the current findings of a study, current opportunities for participation and any decisions that have been made to date. Those stages at which news circulars are most typically issued are:

* to announce the start of a study
* after problem definition
* upon identification of a set of broad alternatives

* when impacts have been identified for the alternatives

* to present the selected alternatives

* to announce the completion of the study

Frequently, news circulars are issued as a means of maintaining a continuing interest in the study as well as documenting the progress on the study in a highly visible manner. This visibility may be especially important during those phases of a study which are primarily technical in nature and offer few opportunities for participation.

(d) Fact sheets are frequently used to present factual study information in a concise manner. Such information is often presented in outline form.

(e) Newspaper and journal articles represent an additional means of publishing information on a study. Newspaper and journal articles are more lengthy than press releases, thereby providing more information. Journal articles normally appear in professional or academic publications whereas newspaper articles are usually written for the general public.

(f) Reports constitute a major element of a public participation program because of the large amount of information pertaining to study methodology or findings which can be disseminated through this medium. The purpose of those reports distributed as part of the Chesapeake Bay Study has been, in part, to educate the public concerning the direction of the study and about the existing and future conditions of Chesapeake Bay's land and water resources. In addition, the report, Impact of Tropical Storm Agnes on Chesapeake Bay documented the socio-economic and biological effects of Agnes.

(2) Objectives - One of the basic objectives of all study publications is to disseminate information to the public. Certain publications are aimed at informing specific publics of study news, while other types are aimed at enlightening the public as a whole. A second objective is to develop interest and support for the study through the dissemination of information.

(3) Advantages and Disadvantages - Each type of publication has its own advantages and disadvantages.

(a) Press releases constitute an easy and simple method of obtaining publicity for a study. They are particularly advantageous because they can reach a large portion of the study area's population. In the case of newspaper press releases, there is no control over where in the paper press releases will appear - a critical factor in determining how many readers see the press release. In addition, it is impossible to control on what day and in what issue the press release will appear.

(b) Information brochures are excellent vehicles for providing information to the public in an attractive manner; however, as in the case with most other publications, brochures produce only one-way communication. The planning agency receives literally no feedback from the public.

(c) News circulars are advantageous because they are a direct means of providing a substantial amount of information to large numbers of people at low costs. They also serve as a permanent record of what has transpired in the program.

(d) Fact sheets are especially useful for distribution to the press in preparation for a news article or press release. They enable the interested public to gain rapid and easy insight into the study. Often, the fact sheet is used by the Public Affairs Office to gain an overview of a particular study so that accurate and objective information can be provided in a relatively short amount of time. One essential requirement is that the fact sheet be updated periodically.

(e) Newspaper and journal articles have many of the same advantages and disadvantages as the information brochure. Journal articles are usually read by members of special interest groups as dissemination is to an already established group of subscribers. Both newspaper and journal articles have a much larger circulation than a brochure and dissemination is more rapid. One of the primary problems of relying on published journal and newspaper articles as a means for public involvement is that it is frequently difficult to get an article published, particularly at the most beneficial time.

(f) Reports can provide a wealth of study information which no doubt can be of use to at least certain elements of the public. It is this characteristic which provides a drawback, however. Reports are frequently too voluminous to be of benefit to the majority of the interested public. A fact sheet or information brochure may provide sufficient information to satisy the majority.

(4) User Experience - The Chesapeake Bay Study, the Baltimore District, and other Bay-related programs have used various publications to inform the public of their respective programs. The following is a description of user experience of each.

(a) Press releases have been issued on behalf of the Chesapeake Bay Study to announce public meetings, the release of study reports and to make important model-related announcements. These releases have usually been issued to Bay area newspapers and radio and television stations. In addition, the releases have been sent to Bay and environmental related magazines.

The Citizens Program for Chesapeake Bay, Inc. (CPCB) has found that weekly newspapers are particularly anxious to receive information in the form of press releases, especially if the information deals with a subject of interest to a large number of people--such as the Bay. Thus, these newspapers are generally receptive to information on studies such as the Chesapeake Bay Study. CPCB is planning to continue use of press releases in order to expand public knowledge of EPA's Chesapeake Bay Program and to solicit comments.

The Virginia State Water Control Board is planning a "media blitz" for rural areas of the Commonwealth in order to inform the public of the 208 Program. Part of this blitz will include newspaper, radio, and TV announcements concerning points of interest about the 208 Program.

(b) Information brochures - The Chesapeake Bay Study Branch has prepared two leaflets, one early in the study program to describe the hydraulic model and its capabilities. The second brochure included, in addition to the information contained in the first brochure, information on model construction, operation, the collection of model data, and model adjustment. The brochure has been widely distributed as handouts at Corps' meetings with groups, at exhibits, at the hydraulic model, and at special events. Copies have also been sent out as inclosures to letters. To date, the brochure has been very successful in disseminating information on the model to the public.

The CPCB has published a brochure briefly describing EPA's Chesapeake Bay Program, its objectives, and information on how the public can obtain further information or express their concerns about the Bay. The public involvement specialists with CPCB believe that such a brochure can make the public much more aware and informed on a study. It is also a useful tool to show how a study will impact personally on the public. In order to distribute such information as widely as possible and to make it available to as many people as possible, CPCB has sent brochures and other Bay-related information to a large number of representative libraries throughout the Region.

(c) News circulars - The Chesapeake Bay Study has published in a series of news circulars. The purpose of these publications was to keep the public informed on both the resource study as well as the hydraulic model testing program. The Baltimore District has published news circulars for several other planning investigations. The District, in cooperation with the Susquehanna River Basin Commission, put out a series of four news circulars in connection with its Susquehanna River Basin Study. In addition, a Citizens Advisory Committee created in connection with the Binghamton Wastewater Management Study, published three newsletters. Recently, a series of five "Water Forum Notes" have been published for the Metropolitan Washington Area Water Supply Study. Each of these series attempted to inform the public about the respective study and to elicit public response concerning the same.

Other Bay-related organizations are currently issuing newsletter type publications. The CPCB initiated a series of newsletters in April-May 1978 entitled Chesapeake Citizen Report. This newsletter is being published as part of the public involvement program for EPA's Chesapeake Bay Program and is distributed on a bi-monthly basis. Articles are also contributed by the States of Maryland and Virginia in connection with their respective coastal zone management programs, by the 208 programs within the Bay Region, and by the Baltimore District in connection with its Chesapeake Bay Study. CPCB's long range plan is to create a type of "Bay-wide" newsletter dealing with all Chesapeake Bay programs. Various state and Federal agencies would contribute articles concerning their respective Bay-related programs.

The State of Maryland has been publishing a bi-monthly newsletter entitled Coast and Bay Bylines in connection with its Coastal Zone Management Program. The State has found this method of information dissemination to the public to be quite effective. Preparation of this newsletter is partially funded by the Office of Coastal Zone Management, of the National Oceanic and Atmospheric Administration.

The Delmarva Advisory Council puts out a monthly publication entitled the Delmarva Report, and the Virginia State Water Control Board issued its first bi-monthly newsletter in June 1978 called Waterlogue which reports on Virginia's project 208 water quality efforts. This latter publication is being funded by the EPA as part of its 208 Program. In addition to these publications, the Interstate Commission on the Potomac River Basin publishes a monthly newsletter entitled Potomac Basin Report. This publication reports on the work of the Commission plus any other news affecting the Potomac River Basin from a water resource standpoint.

The Chesapeake Bay Region appears to have a proliferation of newsletter type publications. Those mentioned above are but a few of the public and private newsletters concerned with some aspect of the Bay's resources presently being published. Each is effective in its own way in disseminating information to the interested public. The question must be raised, however, as to whether the public is being bombarded by these publications to the point where their effectiveness is being reduced.

(d) Fact sheets - The Chesapeake Bay Study together with EPA's Chesapeake Bay Program, the Coastal Zone Management Programs of Maryland and Virginia, and the 208 Water Quality Management Programs of Maryland and Virginia put out a joint fact sheet to describe their respective programs and studies. These fact sheets were distributed to the public through a number of means including at the hydraulic model. The CPCB has put out a number of one or two page fact sheets dealing with various aspects of EPA's Chesapeake Bay Program. These fact sheets known as the EPA Chesapeake Bay Program Information Series include:

(1) Managing the Bay's Resources, a description of major programs being conducted on the Bay including the Corps' study.

(2) EPA Chesapeake Bay Program, a description of the EPA Study organization.

(3) Toxics in the Bay, a discussion of one of the three major study areas of the EPA program.

(4) Bay Grasses, a discussion of one of the three major study areas of the EPA program.

(5) Eutrophication, a discussion of one of the three major study areas of the EPA program.

In FY 79, CPCB is planning on producing and distributing six fact sheets and two brochures to update program progress. In addition, the citizens group will be providing minutes, summaries of technical reports, scopes of work, and other pertinent materials on various aspects of the EPA Chesapeake Bay Program to citizens upon request.

(e) Newspaper and journal articles - In the fall of 1973, Water Spectrum, a Corps of Engineers magazine, published an article on the Chesapeake Bay Study program entitled, Model for a Study. Reprints of the article were obtained and distributed to persons who inquired about the study. In May 1975, Mariners Weather Log, a publication of the National Oceanic and Atmospheric Administration, updated and adopted Model for a Study for their magazine. Reprints of this updated article were obtained and distributed in similar fashion to the Water Spectrum reprint.

Media interest in the study program has been quite high primarily because of public interest in the environment. The Chesapeake Bay constitutes a valuable resource and, as such, generates interest, particularly with reference to the problems which beset it. The Bay study's hydraulic model has also produced considerable public and media interest. Since the model's completion in May 1976, the number of stories initiated by newspapers, magazines, and television stations has increased substantially.

Several newspapers within the Bay Region have run feature articles about various aspects of the Bay and the problems plaguing it. For example, the Baltimore Evening Sun featured a series of articles in 1969 entitled The Chesapeake at Bay which reported on water pollution in the Bay. The same newspaper ran a similar series in 1977 entitled, The Chesapeake: Still at Bay. The Washington Post in a feature article entitled, The Chesapeake Bay Region: The Way We Use It (January 1975) discussed the Bay Region in terms of its resources, its history, and its problems. In addition, the article examined the content of the Chesapeake Bay Existing Conditions Report.

Frequently, certain catastrophic events such as an oil spill or devastating storm will result in a flurry of articles dealing with the Bay. At other times, a conference or seminar dealing with some aspects of the Bay will generate a number of newspaper stories. In each case, District personnel have responded to media requests for information and assisted writers in preparing their stories.

In FY 80 CPCB is planning to produce two newspaper supplements on the Chesapeake Bay Program and will arrange for wide distribution through county weeklies. It has been found that such weeklies are frequently quite receptive to information dealing with the Bay. As it has done in the past, CPCB is also planning to write articles dealing with newsworthy events.

(f) Reports - To date, the Chesapeake Bay Study's planning reports include the Plan of Study (1970), the Existing Conditions Report (1973), the Impact of Tropical Storm Agnes on Chesapeake Bay (1975), the Future Conditions Report (1977), and a Revised Plan of Study (1978).

(1) Plan of Study. The Plan of Study was published in June 1970. It was prepared by the Baltimore District in consultation with the Chesapeake Bay Study's Advisory Group. The document outlines how the study program was to be managed and conducted. So that other interested Federal and state agencies could be informed of the study, copies were widely distributed. In addition, a limited number of copies were sent to individuals and groups who were working closely with the Baltimore District on the study.

(2) Chesapeake Bay Existing Conditions Report (ECR). The ECR is an inventory of the existing chemical, physical, environmental, biological, and economic conditions of the Bay Region. It is primarily a working document for the study participants, but it does contain information that would be of interest to other individuals and groups. The report is available for inspection at the Baltimore District Office and for purchase by the public through the National Technical Information Service (NTIS) of the U.S. Department of Commerce. Due to the high public interest in the Bay study, complementary copies of the ECR were distributed to U.S. Congressmen, Federal, and state agencies participating in or interested in the study, and major public and college libraries throughout the Bay Region.

(3) Impact of Tropical Storm Agnes on Chesapeake Bay. This report was the product of a special study assigned to the Baltimore District, Corps of Engineers to determine the effects of Tropical Storm Agnes on Chesapeake Bay. The report, prepared under contract by the Chesapeake Research Consortium, Inc., is available at the Baltimore District Office, U.S. Army Corps of Engineers. The principal findings of the study were:

- while the Bay suffered considerable immediate economic and environmental damage as a result of the massive freshwater inflows, the Bay demonstrated its resiliency by returning to pre-storm conditions shortly after Agnes subsided;

- while there were some changes in bottom geometry, the changes did not warrant a redesign of the hydraulic model at this time.

(4) Chesapeake Bay Future Conditions Report (FCR). Like the ECR, the FCR serves a dual role as a study working tool and as a public information document. The

purpose of the FCR is to project the future water resources needs and problems of the Chesapeake Bay to the year 2020. The report also includes recommendations for future studies and the model testing required to develop a comprehensive management program for the Bay.

The public distribution was similar to the ECR: copies were sent to all interested Federal and state agencies, to interested research institutions, and to public and college libraries. This report is also available for purchase through NTIS.

(5) Revised Plan of Study (Revised POS). The Revised POS represents a blueprint for the third and final study phase. The selected study program, including model tests to be conducted, and methodology to be used, is discussed in detail.

Other water related study programs within the Chesapeake Bay Region have published reports and made these reports available to the public. For example, the Virginia State Water Control Board as part of its 208 Program, is distributing Best Management Practices Handbooks to interested individuals. These handbooks present information on the most effective, practicable means of preventing or reducing the amount of pollution generated by non-point sources to a level compatible with National water quality goals. The handbooks will be an important part of the 208 Program effort to educate the public. The Maryland Coastal Zone Unit, together with the Federal Office of Coastal Zone Management, has published a final environmental impact statement on the Maryland Coastal Zone Management Program entitled State of Maryland Coastal Management Program and Final Environmental Impact Statement. Prior to publication of this, the State put out a number of drafts of that document for public review and comment. The distribution of these drafts has formed a major part of their public involvement program. The Environmental Protection Agency has also published a number of reports in conjunction with its Chesapeake Bay Program. EPA and the states have both sent their respective reports to representative libraries along with other useful information on their programs. These libraries have been requested to place all Bay-related materials together in one section to create a sort of "Chesapeake Bay repository".

(e) Citizens Advisory Committee.

A citizens advisory committee is usually established for the life of a study and serves as a sort of sounding board for the planning agency. It also serves as an advisor on study decisions and on the public involvement program itself. One important requirement of the committee is that it be representative of the major interests affected by the study. This may necessitate a large citizens committee, which is in itself a drawback, because the group may become unwieldly. These general guidelines should be observed when establishing citizens committees or task forces:

Clearly define the limits of authority of the citizens committee or task force. Typically it is easier to define the authority of a task force because it is working on a specific problem or objective, but it is extremely important that the authority of a citizens committee be defined as there is frequent confusion as to the difference between a citizens committee and a decision-making body. Experience suggests that it is easier for citizens committees to cope with limits to their authorities if they are clearly defined at the beginning of the study. If expectations are created of greater authorities than actually exist, their sense of betrayal is often greater than if there had been clearly defined limits in the first place.

- Citizens committees must be representative of the full range of values within the community. A citizens committee that represents only a few limited viewpoints may serve to mislead the agency and embitter those publics who are not included in the committee. Typically, citizens committees are large enough so that it is possible to have direct representation for all the different viewpoints.

One of the greatest problems in establishing citizens committees is devising an adequate method of selection so that the public does not feel that the agency has stacked or biased the group to assure that positions of the agency are approved.

(1) Composition - In determining the composition of the citizens advisory committee, it is important that the entire study area be represented. Also, a minimum of four public factions to include conservation groups, industry, political action groups and public service agencies should be represented.

(2) Objectives - A citizens advisory committee has as its objectives the following:

- To provide a line of two-way communication between the public and the planning agency to insure the inclusion of public preferences, and desires at each level of the study effort.

- To allow groups with diverging interests to exchange viewpoints and compromise on issues.

- To provide input, that is, the proper mix of social, political, environmental, and economic factors to fulfill needs of the public and meet overall approval.

- To act as a spokesperson for both water resource planning agencies and the general public.

(3) Advantages and Disadvantages - There are both a number of advantages and disadvantages to a citizens committee. The advantages include:

- The citizens committee can serve as an effective sounding board for the agency in identifying study issues and providing reactions to study alternatives.

- Citizens committees provide continuing visibility and credibility to the study process.

- Citizens committees can provide substantial assistance in designing public involvement programs and may even assist in carrying them out.

- Participation by a citizens committee can create an emotional commitment or vested interest in the planning product.

Disadvantages include:

- Difficult to create a committee that is representative of a large, diverse area.

- Citizens committees tend to spend considerable time on organizational details and procedures, such as Robert's Rules of Order, etc., rather than focusing on the content of the study.

- Membership on an advisory committee tends to be time consuming for members of the public and this can breed resentment unless the public feels that their participation on the citizens committee has made a difference in the planning process. In addition, travel is expensive if a large study area is involved.

- Membership on a citizens committee may be frustrating because of differences of expertise between the members.

- Citizens committees may assume an "adversary" relationship between themselves and the agency, and as a result be unable to work effectively with the agency staff.

- Without substantial technical assistance, citizens committees and task forces typically cannot hold their own with the technical expertise of the professional and end up serving as a rubber stamp for the policies of the agency.

(4) User Experience - For the Chesapeake Bay Study, an informal liaison has been maintained with the CPCB. The CPCB was organized in 1971 and is a Bay-wide umbrella organization for other organizations that have some interest in Chesapeake Bay or its water resources. Membership is open to organizations, businesses, industries, and individuals. Serving as the Chesapeake Bay Study's Citizens Advisory Committee, the CPCB reviewed and commented on the drafts of both the Existing Conditions Report and the Future Conditions Report. Insofar as is practicable, the draft reports were revised to incorporate the CPCB's comments. In addition, Corps' planners have met with and corresponded with CPCB representatives in order to coordinate activities.

EPA, as part of its Chesapeake Bay Program, has established a Citizens Steering Committee (CSC) to provide "a focal point for two-way communication between the public and the officials in charge of the program." The CSC is a diverse group composed of 16 citizens who represent a wide cross-section of Bay constituencies, populations and users. Table 1 lists CSC membership. The group has been assigned a number of responsibilities including obtaining information from citizens on water quality in Chesapeake Bay and providing information in return on the EPA program, its purpose, content, and progress. The CPCB, which is responsible for the EPA Chesapeake Bay Program's public involvement program, has also successfully utilized a form of citizens advisory committee for the special purpose of obtaining input on a specific issue or "to bounce ideas off of." Such a group, known frequently as an "ad hoc" committee, serves an useful purpose even though it is utilized on a temporary basis only.

The Maryland Coastal Zone Management program has established a Coastal Resources Advisory Committee (CRAC) to represent all organizations with responsibilities relating to coastal area management. Groups presently represented on CRAC are shown on Table 2. The purpose of CRAC is to provide a public forum whereby voting members can be kept aware of coastal zone management program actions and present their views on proposed programs. Members include special interest groups, local government representatives, local planning staff, state and Federal agencies, and academic institutions.

TABLE 1

EPA CHESAPEAKE BAY PROGRAM CITIZENS STEERING COMMITTEE MEMBERS

Mr. W. Cranston Morgan
White Stone, Virginia 22578

Dr. Elizabeth Bauereis
Baltimore Gas & Electric Company
Charles Center
Baltimore, Maryland 21201

Mr. Davidson J. Gill
Remlik Hall Farm
Remlin, Virginia 23175

Mr. James E. Gutman
233 Wiltshire Lane
Severna Park, Maryland 21146

Mr. Larry Bowlby
Calvert County Court House
Prince Frederick, Maryland 20768

Mr. Walter B. Harris
Blooming Neck Farm
Worton, Maryland 21678

Mr. Erik Jannson
Friends of the Earth
620 C Street, S.E.
Washington, D.C. 20003

Mr. J. William Mapp
Box 26
Onley, Virginia 23418

Mr. Philippe Masiee
Lavino Shopping Company
32 South Street
Baltimore, Maryland 21202

Mr. Richard Fox
Standard Oil Company
1000-16th Street, N.W.
Washington, D.C. 20036

Mr. Donald W. Mathias
Room 809, City Hall
Norfolk, Virginia 23510

Mr. Marvin Hedgepeth
Hampton Institute
Hampton, Virginia 23669

Mrs. Merilyn Reeves
16506 Forest Mill Court
Laurel, Maryland 20810

Mr. Russell C. Scott
513 Mutual Building
Richmond, Virginia 23219

Mr. Larry Simns
48 Maryland Avenue
Annapolis, Maryland 21401

Mr. Lawrence T. Whitlock
Vice-Chairman
3409 Coastal Highway
Ocean City, Maryland 21842

Mr. Donald A. Wilber
Route 6, Box 709
Salisbury, Maryland 21801

Mr. George M. Hagerman
Executive Secretary
5 East Queen Street
Hampton, Virginia 23669

Mr. Richard H. Demmy
Roy F. Weston, Inc.
Westchester, Pennsylvania 19380

TABLE 2

MARYLAND COASTAL RESOURCES ADVISORY COMMITTEE

VOTING MEMBERS

Anne Arundel County[1]

Baltimore City[1]

Baltimore County[1]

Calvert County[1]

Caroline County[1]

Cecil County[1]

Charles County[1]

Dorchester County[1]

Harford County[1]

Kent County[1]

Ocean City[1]

Prince George's County[1]

Queen Anne's County[1]

Somerset County[1]

St. Mary's County[1]

Talbot County[1]

Wicomico County[1]

Worcester County[1]

Chesapeake Bay Foundation

Chesapeake Bay Yacht Clubs Association

Chesapeake Bay Research Consortium

Home Builders Association of Maryland

Bethlehem Steel Corporation

Delmarva Advisory Council

Izaac Walton League of Maryland

[1] Two representatives.

TABLE 2 (CONTINUED)

League of Women Voters of Maryland

Maryland Aggregates Association

Maryland Association of Realtors

Maryland Association of Soil Conservation Districts

Maryland Banker's Association

Maryland Chamber of Commerce

Maryland Conservation Council

Maryland Farm Bureau, Inc.

Maryland Petroleum Association

Maryland Watermen's Association

Maryland Wetlands Committee

Maryland Wildlife Federation

Regional Planning Council

Tri-County Council for Southern Maryland

Utilities Representative

At-large Citizen Representatives (5)

University of Maryland Center for Estuarine and Environmental Studies

University of Maryland Graduate School

NON-VOTING MEMBERS - STATE

Lt. Governor's Office

Maryland Boat Act Advisory Committee

Maryland Department of Agriculture

Maryland Department of Economic & Community Development

Maryland Environmental Trust

Maryland Department of Health & Mental Hygiene

Maryland Department of State Planning

Maryland Department of Transportation

Maryland Port Administration

Applied Physics Lab

Chesapeake Bay Center for Environmental Studies

Chesapeake Bay Institute

TABLE 2 (CONTINUED)

NON-VOTING MEMBERS - FEDERAL

Federal Energy Regulatory Commission

Federal Highway Administration

National Marine Fisheries Service

National Oceanic and Atmospheric Administration

National Park Service

U.S. Bureau of Land Management

U.S. Heritage Conservation and and Recreation Service

U.S. Air Force

U.S. Army Corps of Engineers

U.S. Department of Commerce

U.S. Department of Energy

U.S. Department of Energy - Region III

U.S. Geological Survey

U.S. Department of Health, Education and Welfare

U.S. Department of the Interior

U.S. Navy

U.S. Environmental Protection Agency

U.S. Fish and Wildlife Service

U.S. Maritime Administration

U.S. Soil Conservation Service

In similar fashion to other programs, the Virginia State Water Control Board for its 208 Program, has established both a State Policy Advisory Committee and seven areawide policy advisory committees. Each is to provide public input from private citizens and locally elected officials to the Virginia 208 Program.

f. Public Speeches/Presentation.

Speeches are most often given to interested civic, environmental, and professional groups and business and trade associations on some aspect of the study. These talks are usually accompanied by slides or perhaps a film providing additional description of the study.

(1) Advantages and Disadvantages - Public presentations are effective in providing information to interested groups. In addition, the planning agency can get a certain amount of feedback from these groups concerning public needs and desires. It is also a useful means of stimulating interest in the study. The chief disadvantage is that it is time consuming for the planning agency representatives and only a relatively small percentage of the total public is involved.

(2) User Experience - Due to the public interest in the Chesapeake Bay Study and especially the Bay model, many requests have been received for Corps officials to speak to various organizations. The requesting organizations were generally: engineering or other technical societies; local civic or service groups; environmental organizations; Bay-related businesses; or schools. Geographically, most requests have come from Maryland's Eastern Shore and the Baltimore and Washington Metropolitan areas.

The format for the presentations varied, but usually included a speech by the District Engineer, Chief of the Chesapeake Bay Study Branch, or other District official with either slides or movies as visual aids. To date, hundreds of presentations have been made with a total audience numbering in the tens of thousands. These figures do not include briefings to other Federal and state agencies, Congressional interests, and local government officials.

For the EPA Chesapeake Bay Program, the CPCB is planning a large number of public presentations throughout the Bay Region (96 presentations in FY 79 alone). The presentations will be given to environmental, civic, and other interested groups to provide current information on the Chesapeake Bay Program and to solicit opinions. A record of citizens' comments obtained at these meetings is kept. Comments will be directed to the appropriate EPA and/or state staff for action and efforts will be made to report to the citizens on action taken.

g. Citizen Surveys/Questionnaires.

Citizen surveys are aimed at determining the public attitudes, values, preceptions, and sentiments on various issues. Such a survey normally employs a methodology which ensures participation that is representative of the community being sampled. Methods of sampling usually include phone, mail, or personal interview, but may even employ newspapers, magazines or television (with some sort of return ballot).

(1) Advantages and Disadvantages - The major advantage of surveys is that opinions are received from a more general public, not just those publics which are most directly affected. In addition, if survey results are based on a "representative sample" they may assist in evaluating whether the opinions being expressed by active participants in other public activities e.g., public meetings, are representative of a cross-section of the

community. The advantages of a survey are far outweighed by its disadvantages as shown below:

- Surveys usually do not provide for interaction so there is no way to evaluate the background or basis for the answers givens. It is possible to design surveys to allow inter-action, but this is costly and complex.

- If the issue is not of broad public interest, a substantial number of survey respondents may be uninformed about the issues covered by the survey. The fact that the public is poorly informed about an issue can itself be important information, however.

- Surveys cannot substitute f~ political negotiation between the significant interests.

- Surveys provide a picture of public sentiment at one point in time, and therefore do not reflect changing public attitudes without costly longitudinal studies or other complex techniques.

- The cost of developing statistically reliable surveys is high.

- Unless surveys are carefully designed, they may not produce reliable or meaningful data.

- Questionnaires require prior approval by higher authority under the Federal Reports Act. Obtaining such approval may be long and tedious.

(2) User Experience - The Baltimore District together with the Metropolitan Washington Council of Governments' Citizens Advisory Committee co-sponsored a questionnaire as part of the Metropolitan Washington Area Water Supply Study. The purpose of the questionnaire was to determine what the public felt should be studied as part of the Water Supply Study. Questionnaires were mailed to about 25,000 people and about 10 percent were returned. Although the results could not be considered statistically valid, they were useful as input in determining the direction of the study.

EPA, as part of its Chesapeake Bay Program, will be sponsoring an "assessment of user needs" in the Bay Region. This survey will help identify the needs and uses of the less visible users of the Bay.

In 1978, the CPCB mailed out almost 2,000 questionnaires to environmental, commercial/businesses, and water-related organizations to determine how much knowledge these organizations had of the EPA Chesapeake Bay Program, of water quality problems in the Bay Region, and what they felt the high priority problem areas to be. The response to this questionnaire was as high as 30 percent in some portions of the Bay Region (Virginia).

The CPCB is also planning another questionnaire for FY 79, to be sent out as a supplement to a number of weekly newspapers. This will be closely followed by a TV program on PBS stations to discuss the EPA program and related impacts, and problems which the program will address. The general public will be requested to fill out the questionnaire and mail it back to the CPCB office.

h. Public Forums.

Public forums are generally used to both obtain information and to inform and educate the public. Forums can be used in a variety of ways including meeting with citizens groups or technical organizations to discuss study problems and answer questions; and meeting with other Federal and state agencies to discuss study coordination and problems. The forum is also valuable in bringing certain experts and authorities together in a formal setting to discuss specific aspects of a study program.

(1) Advantages and Disadvantages - The chief advantage of a forum is that it allows for relatively small groups (10 - 12 participants) to sit down together in a "round table" fashion to discuss problems and answer questions on a one-to-one basis. It demonstrates to the public that the planning agency is making a genuine effort to respond to the public's needs. The primary disadvantage is that to be truly productive, public forums require a considerable amount of preparation and can only involve an extremely small portion of the public at any one time.

(2) User Experience - The CPCB has held two public forums in connection with the EPA Chesapeake Bay Program. The first was held in July, 1978 and constituted an informal fact-finding session dealing with herbicides. The second took place in November 1978 and dealt with the water quality effects of dredging and spoil disposal in the Bay. More forums of this type are planned for FY 79. The forums are to be geographically distributed in the Bay area, and will be timed to provide public input to EPA prior to key decision points in the program. Pertinent information will be provided to attendees and responses will be solicited from what is expected to be a broad cross-section of the public.

The Delmarva Advisory Council sponsored a series of public forums on the EPA Chesapeake Bay Program during the spring of 1978. The Council's reaction to these public forums was that while they were well publicized, they were not well attended. The explanation given for this poor attendance is that people are "meetinged" to death. That is, they are tired of being bombarded by many Federal and state programs and efforts to "involve" the public in the planning process.

i. Exhibits.

(1) Purpose - Exhibits are effective as a way of bringing visual information to citizens at locations which are frequented by large groups. In some cases, exhibits may even encourage citizens to take a more active role in a study. A big advantage of an exhibit is that it can be used over and over again in a variety of locations.

(2) User Experience - Many persons became aware of the Corps' Chesapeake Bay Study through the Bay Study Model Exhibit. The exhibit was displayed at many places around the Bay Region, including libraries, engineering centers, and special exhibitions. (Examples of special exhibitions were the Federated Garden Clubs of Maryland Flower Show, Maryland's Scout-O-Rama, and the Baltimore Boat Show.)

The exhibit format changed as the study progressed. Originally, the exhibit consisted of a scale table-top model of the shelter with the leaflet previously described as a handout. Later, posters were added: For some of the exhibitions, movies, such as Planning for a Better Bay or Speaking of Models were shown in an adjoining room. In mid-1975, a 5-minute slide-tape show was prepared and used as an alternative or supplement to the movies.

The Baltimore District, together with several other Federal and state agencies conducting Chesapeake Bay related programs and studies produced a joint exhibit dealing with the Bay. The exhibit, entitled The Chesapeake Bay - Partnership in Use and Protection is an attempt to inform the public of Chesapeake Bay-related programs and at the same time demonstrate the cooperative efforts of a number of Federal and state agencies toward improving Chesapeake Bay and its resources. The exhibit describes the Corps' Chesapeake Bay Study, EPA's Chesapeake Bay Program, the Maryland and Virginia Coastal Zone Management Programs, and the Maryland and Virginia 208 Water Quality Management Programs. Numerous other exhibits have been prepared by the Corps for use at various events.

The Commonwealth of Virginia, in an effort to make the public more aware of its Coastal Resources Management Program, also put together a number of exhibits for display at various festivals and public "outings" during 1977.

j. Delphi Panels.

The delphi panel is made up of a group of experts selected to reach a consensus on a problem through the completion of questionnaires. These experts can be either technical experts or knowledgeable about the interests of some segment of the public. There may be four questionnaires in the series. The first is mailed; responses are received and the results are analyzed and reported in the second questionnaire. Panel members are then asked to respond in light of the responses from others. The process is repeated two more times until a consensus is reached.

(1) Advantages and Disadvantages - Experience with these panels shows that a remarkable degree of consensus can be reached. Delphi panels can be composed of as many as 100 people. Because the responses of the panel members remain anonymous, more frank opinions can be expected. This technique also prevents personality dominance such as sometimes occurs in conferences and allows each panel member to work out his answers to the questions independently.

The disadvantage of a delphi panel is that it is unlikely to be a group representative of the entire citizenry. The findings and consensus from the group should therefore be considered as an additional analysis useful for clarifying and diagnosing a problem and not as the last word on the subject.

(2) User Experience - The Maryland Coastal Zone Unit is considering use of the "delphi" approach. As tentatively planned, a representative group of interested people would be sent questionnaires. They would fill out the questionnaires and mail them back. The responses would be analyzed and reported in a second questionnaire. The process would be repeated several times until a consensus from the group is reached. The Coastal Zone Unit believes that although the cost may turn out to be a hindrance to its use, the delphi approach may be useful.

k. Seminars.

A seminar is a useful mechanism for discussion of issues by agency representatives and by non-agency experts. The seminar is normally focused on a very narrow subject or set of issues. Presentations are made by one or more of the officials and experts. This is followed by a discussion by all other attendees.

(1) Advantages and Disadvantages - The seminar, if properly organized and run, is particularly useful in developing a better understanding of an issue. To be successful, however, a significant amount of time and effort is required in selecting participants, developing format and topics of discussion and in putting together follow-up proceedings.

(2) User Experience - The Chesapeake Research Consortium, under contract with the Baltimore District to study the impact of Tropical Storm Agnes on Chesapeake Bay, sponsored a symposium in March 1974 at College Park, Maryland for discussion of Agnes' effects by all members of the Chesapeake Bay scientific, technical, and managerial community.
Western Eco-Systems Technology, under contract with the Corps to perform a biota assessment in connection with the Low Freshwater Inflow Study, held three seminars during the course of their study. The first seminar was held at the Chesapeake Bay Hydraulic Model on November 15, 1979, and the second in Colonial Beach, Virginia, on March 20, 1980. Working papers were presented at each seminar on the selection of species, the habitat classifications and the biota assessment study methodology. The third seminar was a scientific conference held on October 29, 1981, at the Naval Academy. At the conference, information was presented was showing the rationale and basis for the biota assessment and the preliminary findings.
There have also been two major regional conference-type seminars held since 1968 dealing with Chesapeake Bay and its related resources. The first, called the "Governors Conference," was held at the Wye Institute in September, 1968 and addressed such topics as the Federal perspective on Chesapeake Bay, the role of state government in Bay management, and organizing for coordinated resources management in the Bay. The second conference, the "Bi-State Conference," was requested by principal state officials from Maryland and Virginia, planned and convened by the Chesapeake Research Consortium, Inc. and supported and participated in by the Corps, Environmental Protection Agency, U.S. Fish and Wildlife Service, National Science Foundation, and the National Oceanic and Atmospheric Administration. This second conference was held in April, 1977 at the Naval Air Test Center on the Patuxent River. Focus of the conference was on the "government of Chesapeake Bay" and included discussions of progress achieved and some of the major current problem areas perceived by local, regional, state, and Federal officials. Both conferences provided an enlightened forum for interest groups, agency personnel, and citizens concerned about the future of the Bay. The success of and interest generated by such conferences assures that more will be held in the future. The cost and time involved in preparing and conducting such an activity, however, requires a multi-organizational effort. To conduct something of similar magnitude practically precludes one agency or group from such an undertaking.

l. Charrette.

A Charrette is a problem solving process which brings together all the essential publics in a highly intense and prolonged meeting (or series of meetings) in an attempt to achieve mutual agreement on an overall plan. In order to be effective, all major publics must be present so that a consensus can be reached. Also, participants must agree to stay in a highly intense interaction for however long it takes to resolve differences.

A charrette differs from a workshop in the sense that it is much more intense, usually longer, and unlike a workshop, the charrette continues until its objectives are achieved or the problem is solved.

(1) Advantages and Disadvantages - A charrette has a number of both advantages and disadvantages. On the positive side, the charrette may be an effective means of achieving a consensus among conflicting groups or interests. Second, since all the critical actors are involved, a successful charrette should result in a committment by all significant groups to support any plan which was agreed upon. The intensive nature of the charrette results in changing perspectives or deeper understanding of the positions held by the various groups. Finally, by working together in this intensive manner, previously conflicting interests may develop a feeling of teamwork and cooperation which may extend long beyond this particular study.

In terms of disadvantages, charrettes are effective only when all major publics are willing to enthusiastically participate. Second, since charrettes are inherently time-consuming, it is difficult for some citizens to participate. In addition, it is difficult to get the involvement of key decision makers for the length of time required by the charrette. Finally it is frequently difficult to get participants to change or compromise their views and attitudes.

(2) User Experience - Due to the large commitment of resources required for its success, the charrette is rarely used as a public involvement activity. None of the ongoing Bay-related programs have used the charrette or have had any experience with it.

m. Paid Advertising (newspaper, radio, TV).

Paid advertising has the advantage over press releases or public service announcements in that the planning agency can be assured of proper coverage for a study or meeting. In some cases paid advertising has been looked upon by the public in a favorable fashion as a genuine effort to consult with the public. In other situations, the expenditure of public monies for advertising has been viewed as wasteful.

(1) Advantages and Disadvantages - There are advantages and disadvantages associated with paid advertising for each of the three media involved. Newspaper advertising has the advantage of allowing for the communication of the largest amount of information. However, a newspaper ad typically is a one-time thing and has a life space of approximately 24 hours. Radio advertising has the advantage of a frequently repeated meassage for costs similar or lower than newspaper ads, but the amount of information that can be communicated in a radio ad is somewhat limited. Television advertising has the advantage of reaching the largest number of individuals, but again is limited in the amount of information that can be conveyed. It is also the most expensive media.

There are a number of other advantages and disadvantages. On the plus side, paid advertising will frequently reach larger populations than press releases and advertisements in legal notice sections of newspapers due to the fact that such advertising will probably not be relegated to some obscure place in the paper as a press release might. Also, paid advertising communicates a genuine desire on the part of the agency to reach a larger public.

On the negative side, the use of government funds for paid advertising is not acceptable in all communities. Secondly, the cost of paid advertising may be relatively high for the number of additional people who are reached as a result of the advertisement.

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(2) User Experience - Due to the very nature of paid advertising, its use by government agencies is infrequent. The Corps requires that the District Engineer approve all paid advertising (ASPR, Section 4, Part 8 addresses "Paid Advertisement"). In addition, there must be suitable justification for the advertising. Probably the biggest hindrance to use of paid advertising is its high cost. As an example, a series of classified ads appearing for one week in the Washington Post, Washington Star, and several area weeklies would cost approximately $7,000, (two classified columns, six inches deep).

n. Radio/TV Call-In Shows.

Call-ins are effective as a means of both stimulating interest in the planning program as well as receiving some preliminary comment from the public. Many radio and TV stations have call-in or interview shows, and are eager to grant time on subjects of interest to the public. One of the most useful formats is where an agency obtains a block of time and conducts a call-in show on the issues. A time-lag system allows the questions or comments to be played to the audience. A moderator or perhaps a small panel answers questions. In this way, the public is directly involved in the activity.

(1) Objectives - A TV-Radio forum program has as its objectives the following:

- To be responsive to direct questions from the public and to inform the public of the purpose and direction of the study.

- To involve the public in discussion of water resource planning.

- To stimulate interest and support in the study.

(2) Advantages and Disadvantages There are several advantages of radio and TV call-in shows. First the audience is frequently quite large. Second, the technique is convenient for the public since they can sit in their own homes and respond by phone or mail. Finally, a well-prepared program can be effective in educating the public relative to the issues addressed by the study. There are disadvantages as well, however. The audience viewing the program may not be representative. In addition, unless some participation occurs in designing the program, the agency may not accurately or objectively describe all the issues.

(3) User Experience The Virginia Coastal Resources Management Program has had considerable local television and PBS coverage in the Hampton Roads area which proved effective in making the public aware of the program and in obtaining information on public concerns with regard to coastal resources. The Virginia State Water Control Board is planning PBS programs featuring an EPA video tape on the 208 Program as part of its "media blitz." The CPCB, as part of the EPA Chesapeake Bay Program is planning a coordinated television/press program in each of the major population centers for FY79. This program will be designed to emphasize conflicting uses and problems in order to obtain the concerns of viewers.

o. Audio-Visual Techniques (A-V Techniques).

Audio-visual techniques can be among the most informative, entertaining, and graphic communication tools available to the planner. A-V techniques can be quite effective in both disseminating study information and gathering support for the study.

(1) Composition - Two of the most widely used A-V techniques are films and slide shows. Both can be distributed for viewing to schools, PTA's, planning commissions, industry, public service organizations, political action groups and conservation/environmental groups. Each can also serve as a useful supplement during public presentations.

(a) Films - 16 mm documentary films are produced in order to visually describe some aspect of a study. Information likely to be incorporated includes background information on the study, problems identified during the study, alternatives available and likely solutions to identified problems.

(b) Slide shows - the composition of a slide show is likely to be similar to that of a 16 mm film. Things to be photographed for both films and slide shows must be carefully planned for maximum visual effectiveness.

(2) Advantages and Disadvantages - films are useful because they can be shown to unlimited numbers of citizens. They also can serve as the key ingredient in reaching the largest single audience possible - through television. The chief drawback is the price required to produce a professional film. A second disadvantage is that a film can become quickly out-of-date. Slide shows have most of the same advantages as films plus they cost substantially less than films and can be easily and inexpensively updated on a regular basis. The only disadvantages are that they probably would not prove effective if shown on TV and are not quite as attention-grabbing as films can be.

(3) User Experience -

(a) Two education films have been used in the public participation program for the Chesapeake Bay Study: Speaking of Models and Planning for a Better Bay. Speaking of Models was produced by the U.S. Army Corps of Engineers Waterways Experiment Station. The 28-minute film shows how hydraulic models have been used to obtain information as part of a number of water resources studies. Many of the tests shown in this film can be effectively accomplished on the fixed bed, geometrically distorted Chesapeake Bay Model. Speaking of Models was originally used by the Baltimore District to educate interested groups about hydraulic modeling techniques in general. Because it is technically oriented, however, Speaking of Models has been used primarily for engineering groups following the release of Planning for a Better Bay.

In 1973, Planning for a Better Bay, a film on the Chesapeake Bay Study, was released. This 25-minute film was produced under contract for the Baltimore District. The first half of the movie described the Bay's geologic history, water and related land resources, and problems. The second half described the Chesapeake Bay Study with emphasis on how the Bay model was to be employed in studying the Bay's water-related problems.

Planning for a Better Bay has been widely shown. Distribution of the movie has been accomplished by several different methods: presented as part of a speech by Corps' officials, part of a display at exhibitions; and mailed to groups who requested permission to show it at their meetings.

The movie was first shown publicly in April 1973, and by the end of the year, it had been viewed by 39 groups with an audience of over 4,000 persons. In addition, the film was broadcast by a Baltimore, Maryland, television station thereby greatly increasing its exposure. By September 1977, Planning for a Better Bay had been viewed by over 15,000

persons (not including the 1973 television audience) at approximately 150 separate showings. The film was also shown at the hydraulic model during tours at that site, however, the number of viewers above does not reflect the number which saw the film at the model. Because the film is out-of-date, it is no longer being shown.

In July 1978, the CPCB produced a film concerning the EPA Study. The film features a sailboat race down the Bay along with coverage of the Maritime Heritage Festival held in Baltimore in June, 1978. The film was shown on CBS affiliated stations in the Bay Region in August, 1978. CPCB is also planning to produce three ten-minute films, one each on toxics, eutrophication, and submerged aquatic vegetation. These films are to be shown on television and at meetings.

(b) Most Federal and state agencies have had at least some experience using slide shows as a public involvement technique to describe a particular study or project. Some agencies are having slide shows prepared professionally. Such productions frequently incorporate two sets of slides which are set up so that as one slide "fades out," another "fades in." The result is almost a continuous picture being shown on the screen. A recording frequently accompanies the slides to provide the dialogue.

The Chesapeake Bay Study has a large collection of slides which address the various resource categories with which the study has dealt. Also included are slides dealing with the hydraulic model, study program, management, and findings of the Existing Conditions and Future Conditions reports. These slides have been used frequently for various public presentations.

The following public involvement techniques are unique to the Chesapeake Bay Study. Each will be discussed in terms of how they were used by the Chesapeake Bay Study during the first two phases of the study.

p. Bay Model Tours.

Public tours have allowed interested people to personally view the Chesapeake Bay Hydraulic Model. During the shelter and model construction phases, model tours were limited to scheduled groups. Since the dedication ceremony, the model has been open to the public. Three tours are given daily, Monday through Friday (except holidays) at 10 a.m. and 1 and 3 p.m. The tour consists of a 20 minute slide presentation highlighting the Bay and the problems besetting it and the purpose and scope of the Chesapeake Bay Study and the hydraulic model. The slide presentation is followed by a 40 minute walking tour of the model during which the guide answers questions and directs attention to key points of interest. Special tours for various civic and professional organizations can be scheduled and if the size of the group warrants, several tour guides can be available.

Attendance at the public tours has averaged as much as 125 people per day. During certain days, when large groups are scheduled as many as 350 to 400 visitors have toured the model. Between June 1976 and May 1979, over 53,000 people visited the model. Plans are currently being developed to allow interested model visitors to add their name to the Chesapeake Bay Study mailing list by filling out a special form available from the tour guide.

q. Special Events.

Special events were used to promote public awareness of the Chesapeake Bay Study. Three special events, all linked to the Bay model, have been held: groundbreaking and dedication ceremonies, and an open house.

The groundbreaking ceremony, sponsored by the County Commissioners of Queen Annes County, and was held on 11 June 1973. Over 200 persons attended the ceremony. The presiding officer was Julius Grollman, President of the County Commissioners, and the ceremony included speeches by the late J. Millard Tawes, former Governor of Maryland and first Secretary of the Maryland Department of Natural Resources; and the late Rogers C. B. Morton, former Secretary of the Interior, former Secretary of Commerce, former U.S. Representative, and an original supporter of the Bay study program.

On 7 May 1976, the Chesapeake Bay Model dedication ceremony was held to publicly announce completion of the model's construction and initiation of the adjustment and verification phase. As with the groundbreaking, the dedication was sponsored by the County Commissioners of Queen Annes County. Mr. John M. Ashley, Jr., President of the County Commissioners, was the presiding officer and the late Rogers C. B. Morton was the keynote speaker. Approximately 1,000 persons attended the dedication, which included the filling of the Bay model with water. Following the formal ceremony, visitors were given the opportunity to tour the model at their leisure. Corps personnel were stationed at key locations to answer questions. Media coverage of the dedication included staff from a number of newspapers and several television stations.

While the model was under construction, an open house was sponsored in conjunction with the 1975 Chesapeake Appreciation Weekend held at Sandy Point State Park. Shuttle buses and boats took people from the park to the model and over 1,800 people viewed by Bay Model during that weekend. Each year after that, the completed hydraulic model was again open to visitors during Chesapeake Appreciation Days. Attendance during each of those events was good.

r. Study Coordination and Organization.

Not to be neglected are the number of program activities that serve a public information and participation role, but are primarily supportive of the coordination portion of the total Chesapeake Bay Study. The Corps defines "public" as any affected or interested non-Corps entity, to include other government agencies and officials; public and private organizations; and individuals. The Chesapeake Bay Study was conceived as a coordinated partnership between Federal, state, and local governments and interested scientific institutions. Each involved agency is charged with exercising leadership in those disciplines in which it has special competence and is expected to review and comment on work performed by others. To realize these ends, an Advisory Group, Steering Committee and five task groups, each made up of various Federal and state agency representatives, were established. The overall management of the study is the responsibility of the District Engineer of the Baltimore District. Since its establishment in 1967, the Advisory Group has served as the principal coordinating mechanism for the study, advising the District Engineer regarding study policy and providing general direction under which all study participants have operated. Generally speaking, the Advisory Group has convened whenever it has been necessary to coordinate study efforts, to review and comment on study results, and to determine future study direction and activities.

The Steering Committee for Liaison and Basic Research is charged with reviewing the work of the other study task groups in order to bring to their attention and to the attention of the District Engineer any pertinent technological advances in water resource development or the environmental sciences that may not be explicit in the tasks assigned to these groups. In addition, the Steering Committee formulates plans for scientific activities that may become a necessary adjunct to the study.

Five task groups were established for the Chesapeake Bay Study to include:

a. Economic Projections Task Group

b. Water Quality and Supply, Waste Treatment, and Noxious Weeds Task Group

c. Flood Control, Navigation, Erosion, and Fisheries Task Group

d. Recreation Task Group

e. Fish and Wildlife Coordination Group

Each task group is concerned with related study categories and functions as a basic work group. The chairman designated for each task group is from the Federal agency most closely associated with that particular field of study.

The continued coordination between the Corps and the Advisory Group, Steering Committee, and five task groups has kept important elements of the public informed of study progress and offered them the opportunity to participate in study affairs.

A considerable amount of coordination has taken place with local governments, research institutions, and other non-Corps groups and individuals during the collection of raw data from the first two phases of the study and with the dissemination of study information whenever requests have been made.

INITIAL ALTERNATIVES EVALUATION

Based on the previous analysis, it was possible to screen out those public involvement alternatives which have little or no value for use in the Chesapeake Bay Study. Information provided in Table 3 below summarizes all those alternatives considered earlier and indicates whether or not the technique is recommended for use and why.

TABLE 3

INITIAL ALTERNATIVES EVALUATION MATRIX

Technique	To Be Utilized	Summary Explanation for Retention or Elimination
1) Public Meeting	Yes	Required by regulation; Allows potentially large numbers of the public to be kept informed of study progress and to present public input to the study.
2) Public Hearings	No	Too formal a technique to allow for effective 2-way communication with the public.
3) Workshops	Yes	Allows for extensive interaction and negotiation between agency and various publics; concrete products can be produced from a well organized and well run workshop.
4) Publications		
a. Press Releases	Yes	Useful in informing large portions of total population of study information; relatively inexpensive considering the number reached by this technique.
b. Information brochures	Yes	Effective means of providing detailed information in an attractive format; useful as handouts and for mailings to interested members of the public.
c. News circulars	Yes	Enables study news to be reported on a periodic basis to a relatively large number of the interested public; an inexpensive means of distributing sizeable quantities of study information.
d. Newspaper and journal artilces	Yes	Reaches members of the public who might not be reached by other means; by inexpensive considering the only cost is in preparation of articles; circulation is large.
e. Fact sheets	Yes	Useful for distribution to the press in preparation of a press release; can present basic information in a brief format. Can provide a wealth of study information for use by many elements of the public.
5) Citizens Advisory Committee	Yes	Serves as an effective sounding board in identifying issues and evaluating alternatives and recommendations. Can be useful in disseminating important study information to elements of the public.
6) Public Speeches/ Presentations	Yes	Allows for provision of important study information to interested groups; provides an effective forum for discussion of questions which the public has concerning the study.
7) Citizens Surveys/ Questionnaires	No	Requires OMB approval; representative sample is difficult to obtain and results are equally difficult to interpret.
8) Public Forums	No	To be productive, the techniques requires considerable amount of preparation; involves only a small portion of the public.

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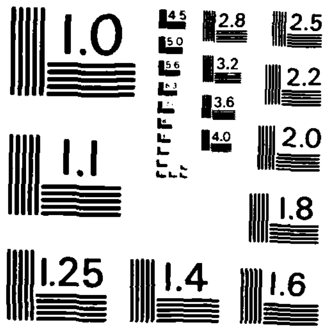

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

TABLE 3 (cont'd)

INITIAL ALTERNATIVES EVALUATION MATRIX

Technique	To Be Utilized	Summary Explanation for Retention or Elimination
9) Exhibits	Yes	Relatively inexpensive to create; can be viewed by a sizable portion of the public at important conferences and events within the study area; can be effective throughout the life of the entire study.
10) Delphi Panel	No	Panel is not representative of the population as a whole, therefore, its usefulness is limited.
11) Seminars	Yes	Significant preparation time and effort is required in order for the seminar to be successful; only a limited number of the public can be involved.
12) Charrette	No	Extremely time consuming to conduct and attend; difficult to get key persons to participate; only effective when all major factions of the public are represented.
13) Paid Advertising	No	Use of Government funds for paid advertising is frequently not acceptable to the public; costs are relatively high.
14) Radio/TV Call-In Shows	No	While the viewing audience is large, actual participation is limited to only a few; questions may not be appropriate; audience is not captive - that is, they may "tune-out" at any time
15) Audio-Visual Techniques		
a) Films	No	Costly; can become quickly outdated.
b) Slide talk	Yes	Can be shown to unlimited numbers; can be updated easily and inexpensively; effective means of providing study information.
16) Hydraulic Model Tours	Yes	Effective means of informing interested elements of the public of the hydraulic model and its capabilities; the model constitutes one of the most important elements of the study and it is one of the most interesting aspects of the study from a public standpoint.
17) Special Events	Yes	Constitute important occasions when relatively large numbers of the public gather to commemorate an event. Can be used effectively to inform the attending public of the study and to show the Corps' interest in what is being celebrated.
18) Study Organization	Yes	A necessary and integral part of a water resource study. The Chesapeake Bay Study was conceived as a coordinated partnership between Federal and state agencies, therefore good study organization is important in order to achieve this coordination.

ANALYSIS OF THE MOST EFFECTIVE MECHANISMS AND ELEMENTS TO BE USED IN REACHING THE INTERESTED PUBLIC

The following is a discussion of those elements which, based on the screening discussed in the prior section, appear to meet the objectives for the Chesapeake Bay Study public involvement program. As such, they should be given further consideration for use during the final study phase. Each will be examined in further detail below in terms of such things as degree of implementation and cost.

a. Public Meetings.

There are three levels of implementation that should be considered for a public meeting program - state, regional and community. With the state level meeting, one meeting would be held for the entire state. As such, state-level meetings are frequently unresponsive to public needs and preferences because the geographic area which must be "covered" by each meeting is too large. People are not willing, or are unable to drive the great distances required to attend such a meeting. Regional level meetings, such as those held for the Chesapeake Bay Study in 1967 and 1976, cover smaller geographic areas and can, thus, be more responsive to the public's needs. Good dissemination of information is possible as is coordination among the public and the planning agencies. The major negative aspect of regional meetings is that total population representation is not possible as in the case of community level public meetings. In the case of the community level meetings, however, there is an excessive cost for the planning agency associated with holding the large number of meetings necessary when a large study area or diversified subject matter is involved. Staff time required to attend such a large number of meetings is also a negative factor.

The estimated cost of holding a public meeting includes cost of preparation, per diem (for long distance meetings), cost to print public notices, and cost of recording, publishing, and distributing minutes. One public meeting within the Chesapeake Bay Region is estimated to cost approximately $10,000. Cost breakdown is as follows:

1.	Preparatic .	$ 7,600
	a. Public notice b. District Engineers' Remarks c. Graphics d. Clerical	
2.	Printing of Public Notice	500
3.	Travel (per diem) $35/day,	
	4 attending meeting	140
4.	Recording, publishing, and distributing minutes	1,800
	TOTAL COST	$ 10,040
5.	Supervisory and Administration Costs	$ 2,575

Total cost associated with each of the three levels of public meetings described above differs slightly due to differences in per diem and staff time required to attend. Thus, the state-level meeting is the least costly since there are only two meetings to attend (one in Maryland and one in Virginia). For the regional level, three meetings would be required for the Chesapeake Bay Region. The community level is the most costly because of the large number of communities.

b. Workshops.

To conduct a planner workshop involves preparation, printing of public notices, travel (per diem), and recording, publishing and distributing the results of the workshops (transcripts). The cost of performing these is estimated to be approximately $11,600 per workshop. Cost breakdown is as follows:

1.	Preparation a. Public Notice b. Format, goals, objectives, discussion topics c. Graphics d. Clerical	$ 9,050
2.	Printing of public notice	600
3.	Travel (per diem) $35/day, 3 persons attending	105
4.	Recording, publishing, and distributing results of workshops (transcripts)	1,800
	TOTAL COST	$11,555
5.	Supervisory and Administration Costs	$ 2,575

Consideration is given to two levels of implementation for the planner workshop. The following paragraphs discuss each of these levels with regard to composition and approximate cost of each.

County and/or Community Level - at this level, representatives from each county and independent city within the study area would be encouraged to participate in workshops associated with the Low Flow, High Flow, and Tidal Flooding studies. Based on the number of counties and independent cities within the Study area (70) plus the fact that perhaps two sets of workshops would be held for each of the three studies, the total cost of the workshop, at this level, will be approximately $112,800. In addition, the cost for three staff members (GS-13, and two GS-12's) to attend each workshop will increase the cost of holding "community" level workshops substantially. The cost breakdown per set of workshops at this level together with supervisory and administration costs is presented in Inclosure 1.

Regional Level - at this level, six regional workshops would be held for both the Low Flow and High Flow studies (2 on the Eastern Shore, 2 on the Western Shore of Maryland; and 2 in Tidewater Virginia) and approximately six for the Tidal Flooding study (one in each flood-prone community under consideration). Cost of conducting two series of workshops for each of the three studies at this level will be approximately $72,500. Cost breakdowns at this level is provided in Inclosure 1.

Considering that there may be several series of workshops for each of the three resource studies, the total cost of adopting a county level workshop program appears to be prohibitive. In addition, to use in-house planning staff for attendance at 70 workshops would prove quite undesirable. This, however, should not preclude having county or community level workshops if the need arises or if specific problems develop. The regional planning level appears reasonable from a cost standpoint and should provide the vehicle for sufficient local input. As most problems to be addressed in the study are of a regional or multi-county scope, the regional workshops should be advantageous.

c. Publications.

Due to the effectiveness of publications in disseminating information, six types of publications are being considered for the final study phase. Each will be discussed below.

(1) Press Releases - They are most effective if they are printed on an as-needed basis. Total cost involved in releasing a news bulletin to the press consists of preparation time in making up the article which is estimated at $150 per press release. The Public Affairs Office will also need to review and comment on each press release, however, it is estimated that the cost to do so will be negligible. Although news will be released to the press when necessary, it is estimated that on the average six press releases a year will be required.

(2) Leaflet/Brochures - During the final study phase, information published in a brochure to describe the Chesapeake Bay Hydraulic Model and testing program could be simply updated as needed or entirely revised on an annual basis. If the model brochure were updated, the total price would include in-house preparation, $500; the cost of a new set of negatives; plus the cost of printing 20,000 brochures. This would cost approximately $4,500. There would only be a need for possibly two updates during this study phase, for a total cost of $9,000. To completely revise the brochure on an annual basis would require in-house preparation and reproduction costs totaling approximately $8,400 per issue. If the brochures were revised for each year remaining in the study, the total cost would run $42,000. A cost breakdown for the information brochure together with supervisory and administration costs is found in Inclosure 1.

(3) News Circulars - This type publication could be printed on either an "as-needed basis" or a more regular basis, perhaps twice per year. A third option to be considered is to simply contribute articles to newsletters of other Bay-related programs.

The cost of producing a news circular in-house would be approximately $5,700 per issue to include preparation and printing costs. The cost of contributing articles to other newsletters would simply include preparation costs or $875 per article. A cost breakdown for in-house preparation appears in Inclosure 1 along with supervisory and administration costs.

A regularly prepared news circular offers the advantage of a more structured preparation and publication deadline. In addition, the public learns when to expect the issue. The major disadvantage, however, is that there may not always be "newsworthy" information available at the time the news circular is to be published. This is the decided advantage of printing a news circular on an "as-needed basis." If study developments warrant printing of two news circulars in one year, then so be it. If few major developments occur during the year, however, than only one newsletter will likely be needed.

While contributing articles to other news circulars is less expensive than printing in-house, it has certain disadvantages. First, one cannot be assured that a particular article will appear when requested, or even if it will appear at all. Secondly, by publishing an in-house news circular for a particular study, that study is given greater public exposure. In addition, format, content, and orientation of a news circular can be determined by the study team, not by some outside group.

(4) Newspaper and Journal Articles - As in the case of press releases, newspaper and journal articles are most effective if they are released on an as-needed basis. Costs associated with newspaper and journal articles involves in-house preparation (writing) and review of the article. Preparation time is dependent on the length of the article. An average article is estimated to take two weeks to prepare (at the GS-12 level) and one week for review and revisions (at the GS-13 level) by the appropriate Planning Division staff as well as Public Affairs Office. Total cost, per article, is estimated to be $1,750 plus supervisory and administration costs of $1,175. If an article is released or published per year for the remainder of the study, it will cost approximately $8,750 for newspaper and journal articles.

(5) Fact Sheets - These should be updated whenever changes in the Study warrant or when significant study progress occurs. Costs associated wilth such updates are negligible since only preparation costs are involved and these should be minimal.

d. Citizens Advisory Committees.

The selection of a body or bodies to serve as the Chesapeake Bay Study Citizens Advisory Committee(s) is a difficult task since there are so many existing groups which represent hundreds of special interests. The first decision in this selection, however, is the number of groups to serve in this advisory capacity. For this analysis, consideration was given to four levels of implementation for citizens advisory committees. The following paragraphs discuss each of these levels with regard to composition and approximate cost of implementation.

(1) Bi-County Level - At this level, adjoining counties within the study area would be asked to form an advisory committee. This approach would result in approximately 35 committees which would undoubtedly be representative of the Bay area public. Assuming Federal study participants would meet with each committee at least eight times during the remainder of the study (4 years), the total cost of preparation for the meetings and per diem is estimated at approximately $24,100 (this does not include staff time for attending the meetings, which for a GS-12 and GS-13 would amount to an additional $57,400). This assumes that two staff members would be able to meet with two citizens advisory committees within one day. For the bi-county level, it was assumed that the advisory committees would be close enough geographically, so that the planning staff could meet with two committees in one day. For the other levels, the committees would not be close enough to do this, therefore a separate day would be required to meet with

each committee. A breakdown of costs for the bi-county level advisory committee is shown in Inclosure 1 along with supervisory and administration costs.

(2) Regional Planning Level - At this level, the regional planning areas which have been established within the involved states would each be asked to form a citizens advisory committee. This would consist of 16 committees representing the Baltimore Regional Council, Southern Maryland Regional Office, Upper Eastern Shore Regional Office, Lower Eastern Shore Regional Office and the Washington Metropolitan Council in Maryland; Planning Districts 8, 15, 16, 17, 18, 19, 20, 21, and 22 in Virginia; and one group each from Pennsylvania and Delaware. Costs for this level were based on the same assumptions used for the bi-county level. Total costs for implementation at the regional planning area level are estimated at $23,000, (assuming the planning staff could only meet with one committee per day). Cost in "staff time" to attend these meetings would be an additional $49,200.

(3) State Level - On the state level, four citizens advisory committees would be established - one each in Maryland, Virginia, Pennsylvania, and Delaware. As above, the cost for the program is based on the Federally sponsored meetings of the committee and periodic dissemination of information to each of the committees. The estimated cost of this program is $16,200 (assuming the planning staff could only meet with one committee per day). "Staff time" to attend a total of 40 meetings would cost $12,300.

(4) Study Area Level - At this level, one advisory committee would represent the entire study area. This level would present the least costly alternative with a total estimated cost of $14,300. This represents preparation time for 8 meetings but includes per diem for only 4 meetings since half could probably be held in close proximity to the Baltimore District Office. The establishment of one comprehensive citizens committee would provide the water resource planner with the maximum ease in coordination and feedback from one group of knowledgeable, water resource influentials at the expense of some loss in responsiveness to regional and local needs. The cost of "staff time" to attend these meetings would be $3,300. It should be noted that costs for various levels of implementation do not vary in terms of preparation time, but rather in terms of per diem and "staff time" required to meet with these committees.

e. Public Presentations.

Public presentations or speeches dealing with the Chesapeake Bay Study are given on an as-needed basis. Judging on past experience, approximately 12 speeches per year are given (one per month). Preparation for a public speech makes up the chief unit cost. However, once a speech is prepared, it can be used again and again with only minor modifications to fit the group and occasion. Preparation costs are estimated to be $875 (one man-week for a GS-12). The standard Chesapeake Bay Study speech will probably have to be significantly modified approximately three more times during the remainder of the study for a total cost of approximately $2,600.

f. Seminars.

An educational seminar, held at the hydraulic model, would increase understanding of the hydraulic model by the academic and scientific communities. Such a seminar would also be useful in informing certain elements of the public of the findings and results of model tests. The agenda for an educational seminar might include a discussion of hydraulic modeling, the Chesapeake Bay Study program, description of the Chesapeake Bay

Hydraulic Model operation and tour of the facility, and use and application of model data. Cost to conduct such a seminar consists primarily of preparation which is expected to amount to $3,350. A breakdown of these costs is as follows:

Professional preparation (1/2 - GS-12 man-month)	$ 1,750
Clerical	600
Total	2,350

An additional cost of preparing for the seminar is the cost of staff required to actually conduct the seminar. This would run about $1,000 assuming that the senior staff from the Chesapeake Bay Study Branch were involved.

Total cost of conducting an "educational seminar" at the hydraulic model is $3,350. Supervisory and administration costs are estimated at $5,150.

g. Slide Shows.

A slide show for use with the general public during the final study phase would likely include the following:

(1) Background information on the Chesapeake Bay Study (how and why it was authorized, the need for the study, authorizing legislation).

(2) Description of the resources and uses of the Bay.

(3) Current threats and problems facing the Bay - conflicts.

(4) Construction and verification of the hydraulic model.

(5) Information on model capabilities and potential tests to be run.

(6) Description of the formulation of a hydraulic model testing program.

(7) Description of the tests to be run including the Low Flow, High Flow, and Storm Surge Tests.

(8) Information on the public involvement program.

The chief costs associated with putting a slide talk together include time required to take the slides, processing and editing of slides, and preparation of the talk to accompany the slides. This totals approximately $5,900. A breakdown of cost includes:

Photography	$ 3,500	(1 man-month for a GS-12)
Processing	150	
Editing	500	
Preparation of the talk	1,750	(1/2 man-month for a GS-12)
Total	$ 5,900	

An alternative to a slide show prepared in-house employing conventional audio-visual equipment is to employ a "dissolve unit" and to have the slide show professionally prepared. The "dissolve unit" fades one slide out while fading another slide in. The tape recorder provides the dialogue and background music. The cost of this equipment, including the two projectors, dissolve unit, and recorder is approximately $1,000. The cost of having a slide show prepared professionally is $4,000 plus the cost of administering the contract. To administer such a contract would take a GS-12 about one month for a cost of $3,500. The advantage of this alternative is that the end product may be better. The obvious disadvantage is the increased price.

h. Model Tours.

A possible means of improving tours of the model includes administration of a short questionnaire that could be filled out if desired by model visitors. The tour guide would advise visitors of the purpose and availability of the questionnaire. A second means of improving tours would be to give interested visitors the opportunity to add their name to the Chesapeake Bay Study mailing list so they could receive important study information and announcements.

Cost of making either or both of these changes is negligible.

i. Special Events.

While participation in special events is both important and necessary, the cost to conduct such events for the remainder of the study is difficult to determine. Therefore, no attempt will be made to do that here.

j. Study Coordination and Organization.

Continued coordination with the study organization, to include the Advisory Group, Steering Committee, and five task groups will be a necessary and important aspect of the final study phase due to the significant role which these groups will play during this phase. Total cost to coordinate with the study organization depends on level of coordination. Cost includes preparing for, coordinating, and distributing the minutes for the Chesapeake Bay Advisory Group, Steering Committee, and Task Group meetings. Cost to hold three more Advisory Group Meetings (FY 80, 81, and 82), three more Steering Committee meetings (FY 79, 80, and 81), and two meetings of each of the five Task Groups (FY 79 and 81) is estimated to be $43,000. For each of these groups to meet once per year for the remainder of the study would cost about $70,000. While the cost for this greater level of coordination is substantially more, it may be necessary due to the nature of the final study phase. A breakdown of cost for the Advisory Group, Steering Committee, and the Task Groups is provided in Inclosure 1 along with supervisory and administration costs.

In addition to the coordination meetings planned with the study organization, there is also a very strong need for day-to-day coordination. Also, the Advisory Group and Steering Committee representatives will be asked to review key program documents such as the various test proposals for the model, WES reports on testing results, and any interim resource study reports. Input which these bodies might provide in review of these materials will prove invaluable in the overall study results.

RECOMMENDED PROGRAM

Based on the above analyses of public involvement techniques which have proven effective in dealing with the public and which are applicable for use in the Chesapeake Bay Study, the following is a detailed description of the recommended program for public involvement during the final study phase.

a. Public Meetings.

Two series of public meetings are recommended for the final study phase. Each series will combine discussion of the Low Flow, Tidal Flooding, and High Flow studies. The first series is scheduled for Fiscal Year 1981 and will have as its overall purpose to present information on the various alternatives being formulated as part of the Low Flow, High Flow, and Tidal Flooding studies. More specifically, for the Low Flow Study, information will be provided on those alternative levels of freshwater inflow that are under consideration in the study and the identified social, economic, and biological impacts of those flows. Comments will be obtained concerning the public's views of the impacts associated with these alternative inflows.

For the Tidal Flooding Study, information will be presented on the results of both the flood damage surveys and the average annual damages calculated for those flood prone communities which have been singled out for further investigation. These communities for which feasible solutions to tidal flooding problems may exist will be identified as will the alternative structural and non-structural means available to prevent or reduce flooding problems in these communities. Public response will be gathered on perceived impacts of various flood frequencies as well as what the public views as the most acceptable means of providing protection.

With regard to the High Flow Study, the public will be asked to present their views on the impacts of various high flow events, such as Tropical Storm Agnes, on the Bay Region.

Due to the nature of discussion at this series of public meetings, both the regional level and community level meetings are required. Regional level meetings will be held in the same general locations as those of prior Chesapeake Bay Study public meetings: Baltimore - Annapolis; Tidewater Virginia, and the Eastern Shore of Maryland. The community level meeting will be held in the community or communities where some form of flood control is feasible. It is assumed, then, that there will be a total of four meetings held during this series (three regional, and one community-level). Cost for this series is estimated to be $10,500.

The second series of public meetings, to be help in Fiscal Year 1983, will again be multipurpose. First, to present information and gather public response on the final alternative low flows recommended in order to maintain the Bay's socio-economic and environmental integrity. Second, to present the set of specific structural and/or non-structural measures to be recommended for each community which are responsive to the Tidal Flooding Study planning objectives, and to gather public response on these measures. Finally, to allow the public to respond to any high flow recommendations which might be offered.

Discussion at this series of meetings, will require both the regional level and community level meeting. Each will be held in the same approximate location as the first series of public meetings. In addition, however, a regional level meeting may be required in

Harrisburg, Pennsylvania since considerable discussion will deal with low flows to be maintained on the Bay's tributaries and the very broad, general means of achieving these inflows. Since the Susquehanna River is the Bay's major tributary, the value of holding a meeting in that basin is obvious.

The cost for this second series of meeting will be approximately $10,600. The total cost for both series of public meetings for the final study phase is thus $21,100. The cost of staff to attend these meetings is estimated to be $5,500 (assuming, first, a GS-14, two GS-13's, and two GS-12's attend each meeting and second, each meeting would take approximately one-half day).

b. Workshops.

Two series of workshops are recommended for the final study phase. Each will coincide with the respective series of public meetings and will be held at the same approximate times and locations as the two series of public meetings.

Each series of workshops will be organized into three sessions with each session addressing one of the three studies: the Low Flow, Tidal Flooding, or High Flow study.

At the low flow session during the first series of workshops, (tentatively scheduled for Fiscal Year 1981) participants will be asked to reach some consensus as to what they perceive the socio-economic and environmental impacts of various low freshwater inflows to be. The feedback obtained from this session will be useful in better understanding the public's priorities for maintaining the Bay in the future. This information will be used as input in the formulation and evaluation of alternative flows required to alleviate the identified low flow problems.

During the tidal flooding workshop session, the impacts of the various flood frequencies run on the hydraulic model will be discussed as will some of the structural and non-structural measures under-consideration in each identified flood-prone community. The output of this session will be used in the early stage of formulating and evaluating the detailed alternative means of tidal flood protection.

At the high flow session, emphasis will be placed on a discussion of impacts associated with various high flow events, such as Tropical Storm Agnes, and any structural or management measures that could be used to prevent or reduce the adverse impacts of high freshwater inflows. The High Flow Model Test will be underway at the time this series of workshops is held, therefore, no model results will be available for discussion or consideration.

At the second series of workshops, participants will again be given the opportunity to attend one of three concurrent sessions, each dealing with a specific study. At the low flow session, discussions will center around the final set of low flows to be recommended and the perceived socio-economic and environmental impacts associated with this set of flows. The results of this session will be used in the final alternative analysis.

At the tidal flooding session, the specific structural and/or non-structural measures proposed for each community will be discussed along with assessments of the impacts of each. Results of this session will provide analysis of the final flood control recommendations.

The high flow session will address the results of the high flow model tests and the impacts associated with any structural or management measures to be recommended.

The cost of conducting these two series of workshops is estimated to be $24,500. This figure does not include the cost of staff time required to attend the workshops. This is estimated to run about $2,900 for a total of nine workshops (assuming first, a GS-13, and two GS-12's attend each workshop and second that a workshop will last one-half day).

Past experience of the Baltimore District in using outside organizations and groups to assist in the conduct of workships has been very positive. It is therefore recommended that a contractor be considered for use in assisting with the two series of workshops planned for the final study phrase. The contractor would be expected to aid in development of format and in organizing, conducting, and assessing the results of the two series of nine workshops.

The advantage of contracting workshops is that it frees planning staff for other tasks. One possible group which could be used as a contractor to assist in planning and running the workshops is a citizens advisory committee.

c. Publications.

News circulars have been shown to be an effective means of informing a large portion of the area's population of activities and developments affecting the Chesapeake Bay Region. The success of the Chesapeake Bay Study's first two news circulars is particularly encouraging. Because of their usefulness, it is recommended that a total of at least seven additional news circulars be published during the remainder of the study (FY 79 - FY 83) on an "as-needed" basis. Articles will deal with the results of specific hydraulic model tests and information on the resource study such as socio-economic and biological impacts of high and low flow conditions and tidal flooding on the Bay Region, and information on those flood prone communities selected for detailed study. As with the first publications, news circulars will be distributed to those entries on the Chesapeake Bay Study mailing list including Federal, state, and local government agencies, Congressional representatives, locally elected officials, news media, concerned civic and environmental groups, and interested citizens.

The total cost of preparing and printing eight news circulars will be approximately $45,600.

Articles dealing with the Corps' Chesapeake Bay Study will be contributed to other Federal and state agencies involved in related programs for inclusion in their news circulars. This is an inexpensive way to pass information on to members of the public who might not be on the Chesapeake Bay Study mailing list. It also provides a good opportunity to coordinate with related Federal and state programs. This is estimated to cost $3,500 (assuming one man month for a GS-12 for the remainder of the study).

The widespread circulation of newspapers makes them an important information media to be used. Studies have shown that press releases to newspapers, and radio and television networks along with the issuing of newspapers and journal articles are the most effective and cost efficient means of reaching the largest number of people. It is therefore recommended that both press releases and newspaper and journal articles be issued whenever newsworthy study developments occur. Due to the large size of the Study Area, there are a large number of newspapers, and radio and TV stations which must be

contacted for the dissemination of information. The number of newspapers which would be involved in a Bay-wide distribution totals approximately 160. TV and radio stations total an additional 165. Each of these 325 newspapers, and TV and radio stations are currently on the Chesapeake Bay Study mailing list. If each of these were to issue a press release, a large percentage of the Bay region's total population could be reached.

The cost of issuing approximately 30 press releases during the remainder of the study is estimated to be $4,500 (this assumes that although press releases are issued on an "as-needed" basis, there will be an average of 6 per year). The cost is solely for preparation since networks normally donate free "air-time" for public service type announcements and there should be no charge for placing information in newspapers.

The cost of releasing an average of one newspaper and/or journal article per year for the remainder of the study is estimated to be approximately $8,750.

Fact sheets are recommended for use during the final study phase. The cost of updating fact sheets is negligible, however, since preparation costs will be minimal.

Making reports available to the public is an important and necessary part of a public involvement program. The final report of the Chesapeake Bay Study will be available to the public through representative libraries in the Region and through the Department of Commerce's National Technical Information Service. The final report will be composed of several segments. The first segment will include a summary of all the existing and future water resources problems and needs of the Bay Region as identified in both the Chesapeake Bay Existing Condiltions and the Chesapeake Bay Future Conditions Reports. The second segment of the report will include a discussion of the methodology used to formulate and select those priority problems to be addressed in the third and final phase of the Chesapeake Bay Program. Lastly, the third segment of the report will include the findings and recommendations of the detailed Low Flow, Tidal Flooding, and High Flow studies.

In reference to information brochures, it is recommended that the current model brochure be updated periodically rather than completely revised. The information currently contained in this publication is of such a nature that complete revision is unnecessary. Information dealing with specific model tests which might be incorporated into a revised brochure can be reported in the series of news circulars which are to be published during the final study phase. Cost of updating and printing the brochure twice during this study phase will be $9,000.

d. Citizens Advisory Committee.

The inefficiency associated with maintaining coordination with a large number of county level advisory committees or even several regional or state level groups makes their use prohibitive. Therefore, it is recommended that liaison be maintained with only one group - one that is representative of the overall Bay Region population.

Due to the nature of the final study phrase, a citizens advisory committee should assume a more formal role than that held during the first two study phrases. Specifically this committee should take on several new responsibilities over what it has had, to date. First, the committee should be asked to review proposals for the public involvement program and make recommendations regarding these proposals. This would be a "continuing responsibility" in that throughout the remainder of the study, the committee

would advise the Baltimore District on its Chesapeake Bay public involvement activities. The Committee would also serve as a two-way channel of information - providing feedback on the public's interests, needs, and concerns, and in turn carry information through their organizational newsletter, to the public on major decisions and outputs of the Chesapeake Bay Study.

A second major responsibility, as mentioned earlier, might be for the citizens advisory committee to serve as the contractor during the planning, conduct, and assessment of the series of workshops planned for Fiscal Years 1981, and 1983. Specific duties as contractor might include:

1. Providing a list of persons and organizations to be invited to the workshop.

2. Arranging for a meeting place and taking care of all other preparations.

3. Assisting in development of a workshop format and topics of discussion.

4. Providing an assessment of the workshops to be used as input for the District's overall assessment.

A third responsibility would be for a representative of the citizens advisory committee to sit as an observer during Chesapeake Bay Study Advisory Group meetings. The representative would be able to provide public input, thus assisting the Advisory Group in their decision-making duties. With a citizen representative serving on the Advisory Group as an observer, the public would feel as though they had some input into the decision-making process and the overall planning process would be enhanced as a result.

The cost of coordination with the citizens advisory committee for the remainder of the study is approximately $14,300. This includes cost of preparing for a total of eight citizens advisory group meetings to be held during the remaining five years of the study. The cost of two staff members attending each of these meetings would be an additional $3,300. These prices do not include the day-to-day coordination which will be required in addition to the more formal meetings.

e. Public Presentations.

It is recommended that public presentations (speeches) be given whenever requests are made by the public. Due to the fact that the total number of presentations will depend on the number of requests, it is difficult to estimate the total cost or the time of the individuals giving the speeches. The cost of preparing speeches for the remainder of the study is estimated to be approximately $2,600 (assuming that only about three separate speeches should have to be prepared and then revised or updated to "fit" the occassion).

f. Seminars.

It is recommended that two educational seminars be held at the model in order to better educate the academic and scientific communities of the capabilities and accomplishments of the Chesapeake Bay Hydraulic Model. The first seminar was held in November 1979, the second is scheduled for 1981. The purpose for conducting a second seminar is twofold. First, testing will have been completed by 1981. Results of most of these tests will be available for analysis and should provide interest to those attending.

Secondly, many who were unable to attend the first seminar will be given an opportunity to attend the second. The cost of conducting two seminars is estimated to be approximately $6,700.

g. Slide Show.

It is recommended that the District Public Affairs Office (PAO) produce and fund a professionally prepared slide show. A "dissolve unit package" (2 projectors, an audio-visual type tape recorder, and a dissolve unit) is suggested for use to present the slide show. While such a slide presentation will cost more than a similar one prepared in-house, the quality will most likely be greater. Considering the intensive use which such a show will receive, the increased cost will be more than compensated. Cost to produce a professional slide show (including contract administration) and to purchase a dissolve unit package is estimated to be approximately $8,500, to be borne by the PAO.

h. Model Tours.

The success of the model tours during the period in which the model has been open to the public (since May 1976) warrants their continuation as a means of informing the public of the model and of developing interest in the study. The cost for a full-time tour guide (GS-4) makes up the primary cost associated with these model tours. The cost of conducting tours for the remainder of the study is estimated to be $68,800. This does not include supervisory and administration costs. In September 1979, a new visitors center at the model was ready for use by the public. The center includes an exhibit area, and 150 - seat wood-paneled auditorium. The cost to construct this visitors center was approximately $186,000.

Visitors at the hydraulic model represent an important, but as yet underutilized resource in terms of public involvement in the Chesapeake Bay Study. By requesting certain information of those persons touring the model, it will be possible to obtain some valuable information on members of the public who have expressed an interest in the Chesapeake Bay Study. First, it is recommended that forms be made available to those visitors who wish to have their names added to the Chesapeake Bay Study mailing list so that they may be kept informed of study progress. Second, it is suggested that either a short questionnaire dealing with the study or a suggestions and comments sheet be made available for visitors to fill out, if they desire.

i. Special Events.

Based on the amount of public interest generated by special events such as Chesapeake Appreciation Weekend and Queen Anne's Day Celebrations, it is recommended that the Chesapeake Bay Study be represented during Bay-related special events. Participation will likely include opening the model for tours during celebration weekends; preparing remarks or speeches which address the Chesapeake Bay Study, to be given at designated times during the ceremony; and distributing written information discussing certain aspects of the model or overall study. Cost to participate in such events would run about $1,000 per event. The cost of providing tour guides and physically opening the model to the public would constitute the greatest portion of this cost. Materials to be distributed would already be in existence and remarks presented at the celebrations could be taken from existing speeches; therefore, these costs would be minimal. Total costs for participating in two such events for the balance of the study will run $10,000. These costs are to be taken from PAO's budget since they are model-related.

j. Study Coordination.

The need for full coordination with the study organization has been discussed earlier. It is recommended that the Advisory Group, Steering Committee, and each of the study's five task groups meet on the average of once per year for the remainder of the study in order to maintain the coordination necessary to conduct an effective study. Cost for this level of coordination is estimated to be $70,000. Staff costs to attend are estimated to be $22,000 (assuming, first, a GS-14, Two GS-13's, and two GS-12's would attend; second there would be a total of 24 meetings held; and third, each meeting would take approximately 1 day).

In addition to coordinating with the study organization, it is also recommended that emphasis be placed on coordinating public involvement activities with those of other related Federal and state programs in an attempt to avoid duplication of effort and to demonstrate to the public that existing programs are complementary rather that duplicative. To date, coordination efforts are underway. Articles dealing with the Corps' Chesapeake Bay Study have appeared in the newsletter prepared by the Citizens Program for Chesapeake Bay for the EPA Chesapeake Bay Program entitled "Chesapeake Citizen Report" and in the newsletter prepared by the Delmarva Advisory Council entitled "Delmarva Report." Design and construction of a joint Chesapeake Bay exhibit/display was recently carried out by the Corps', the Citizens Program for Chesapeake Bay (on behalf of EPA's Chesapeake Bay Program), the coastal zone management programs in Maryland and Virginia, and the 208 programs in Maryland and Virginia. The exhibit is being used in libraries throughout the Bay Region and for display at Bay-related conferences and seminars. The exhibit shows the main thrust of these programs and demonstrates the cooperative efforts between them. A joint "Fact Sheet" has also been completed to describe in some detail each of the above programs. The fact sheet is being distributed at the hydraulic model as well as at the Chesapeake Bay Exhibit. Cooperative efforts such as the above have been well received by other the participating Federal and state agencies as well as the general public.

Other potential cooperative efforts between the Corps' Bay study and related programs might include joint workshops, forums, and/or a film. The advantages of sharing in any or all of these are obvious: time and cost involved in planning for, conducting, and assessing a joint workshop or forum would be cut considerably. The same with a film. In addition, the public would see firsthand how two or more programs were coordinating in an effort to find solutions to the Bay's problems while avoiding duplication. An example of such a cooperative effort might be a workshop jointly sponsored by the Corps and the Maryland CZM program to address tidal flooding problems within the State. The objective of such a workshop might be identical with those workshops described in earlier sections.

The CZM unit may be interested in cooperating in such a workshop in order to make citizens aware of Maryland's program to identify state critical areas suitable for conservation.

The total cost of coordinating Bay-related programs with various Federal and state agencies during the balance of the study is estimated to be $15,000.

TOTAL PROGRAM COST

In order to carry out the recommended public involvement program for the final study phase, a total of $225,600 is needed. The breakdown of this cost figure is presented in Table 4 below.

TABLE 4

Public Meetings (two series)		$ 21,100
Public Workshops (two series)		24,500
Publications		
News Circulars (eight)		45,600
Articles Contributed to Other News Circulars		3,500
Press Releases (30)		4,500
Newspaper and Journal Articles (Ive)		8,800
Information Brochures (two)		9,000
Citizens Advisory Committee		14,300
Public Presentations		2,600
Seminars		6,700
Coordination with Study Organization		70,000
Coordination with Related Federal and State Programs		15,000
Chesapeake Bay Study Public Involvement Program Cost	SUBTOTAL	$ 225,600
Supervisory and Administration Costs (CBSB)		$ 28,100
Public Affairs Office (PAO) Costs (Visitors Center, tour guide, slide show, special events)		$273,300
	TOTAL	$ 527,000

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DETAILED COST ESTIMATES FOR PUBLIC INVOLVEMENT TECHNIQUES

Technique/Major Tasks Involved	Costs
A. Workshops - Regional Level (6 workshops per series)	
1. Preparatior a. Public Notice b. Format, Goals, Objectives, Discussion Topics c. Graphics d. Clerical	\$ 9,050
2. Printing of Public Notice	\$ 600
3. Travel (per diem) \$35/day, 3 persons attending each workshop	630
4. Recording, Publishing, and Distributing results of workshops (transcripts)	1,800
Total Costs (Regional Level)	\$ 12,080
5. Supervisory and Administration Costs	\$ 2,575
B. Workshops - Community Level (70 workshops per series)	
1. Preparation a. Public Notice b. Format, Goals, Objectives, Discussion Topics c. Graphics d. Clerical	
2. Printing of Public Notice	600
3. Travel (per diem) \$35/day, 3 persons attending each workshop)	7,350
4. Recording, Publishing, and Distributing results of workshops (transcripts)	1,800
Total Cost (Community Level)	
5. Supervisory and Administration Costs	\$ 2,575

Inclosure 1

Detailed Cost Estimates for Public
Involvement Techniques (con't)

Technique/Major Taks Involved	Costs
C. Information Brochures	
1. In-House preparation	$ 4,400
2. Reproduction	
a. Creation of negatives	300
b. Printing (20,000 copies)	3,700
Total Cost	$ 8,400
3. Supervisory and Administration Costs	$ 2,575
D. News Circular	
1. In-house preparation	$ 3,900
2. Printing	
a. Creation of negatives	300
b. Printing	1,500
Total Cost	$ 5,700
3. Supervisory and Administration Costs	$ 3,750
E. Citizens Advisory Committee (Bi-County Level - 35 groups)*	
1. Preparation for meetings	$ 1,750
a. Professional preparation	
b. Clerical	
c. Graphics	
2. Travel (per/diem) $35/day, 2 persons attending each meeting	1,260
Total Cost (per Community Level meeting)	$ 3,010
3. Supervisory and Administration Costs	$ 2,575

*It should be noted that considerable staff time would be required to attend this many Advisory Group meetings. Thirty-five groups meeting eight times during the remainder to the Study would result in 280 meetings. This means that 7 man-months of meetings are required if a GS-13 and GS-12 are able to attend two meetings per day. Total cost for "staff time" to attend these meetings is, thus, $57,400.

Detailed Cost Estimates for Public
Involvedment Techniques (cont'd)

F. Coordination with Study Organization

1. Advisory Group (per meeting)

a. Preparation	$ 3,800
b. Distribution of Minutes	200
Total Cost	$ 4,000
c. Supervisory and Administration Costs	$ 2,575

2. Steering Committee (per meeting)

a. Preparation	$ 3,800
b. Distribution of Minutes	200
Total Cost	$ 4,000
c. Supervisory and Administration Costs	$ 2,575

3. Task Groups (per meeting)

a. Preparation	$ 1,700
b. Distribution of Minutes	200
Total Cost	$ 1,900
c. Supervisory and Administration Costs	$ 2,575

Inclosure 3

ATTACHMENT B-2

CHESAPEAKE BAY STUDY

COMMITTEE REPRESENTATIVES

ADVISORY GROUP

DEPARTMENT OF AGRICULTURE

Edward R. Keil, 1967-70
C. Douglas Hole, 1970-72
Graham T. Munkittrick, 1972-76
Gerald R. Calhoun, 1977-84

DEPARTMENT OF COMMERCE

Phillip K. Reiss, 1967-68
Howard J. Marsden, 1968-70
Henry L. DeGraff, 1970-83

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

Gerald W. Ferguson, 1967-70

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

Mark Keane, 1967
Jerome E. Parker, 1967-68
Thomas M. Croke, 1968-76
Lawrence Levine, 1976-84

DEPARTMENT OF THE INTERIOR

Eugene T. Jensen, 1967-68
Lloyd W. Gebhard, 1968
Mark Abelson, 1968-73
Ellen Jensen, 1973
J. David Breslin, 1973-75
Roger S. Babb, 1975-78
William Patterson, 1978-83
Anita Miller, 1983-84

DEPARTMENT OF TRANSPORTATION

Philip E. Franklin, 1967-70
ADM E. C. Allen, Jr., 1971
Capt. Winford W. Barrow, 1971-72
Capt. G.H. Patrick Bursley, 1972-74
Capt. Keith B. Schumacher, 1974-78
Capt. J.W. Kime, 1978-81
Capt. J.C. Carlton, 1981-84

ATOMIC ENERGY COMMISSION

Dr. Jeff Swinebroad, 1968-73
Dr. Ford A. Cross, 1973-75

DEPARTMENT OF ENERGY

Dr. W. Roland Taylor, 1975
Dr. Jackson O. Blanton, 1975-76
Dr. D. Heyward Hamilton, 1976-84

ENVIRONMENTAL PROTECTION AGENCY

Lloyd W. Gebhard, 1971
William M. Blankenship, 1971-73
Larry S. Miller, 1973-74
Green Jones, 1974-76
Leonard Mangiaracina, 1976-79
Dr. Tudor T. Davies, 1979-83
Thomas P. Eichler, 1983-84

FEDERAL ENERGY REGULATORY COMMISSION (FEDERAL POWER COMMISSION)

Paul H. Shore, 1967-72
John H. Spellman, 1972-74
Angelo Monaco, 1974-76
James D. Hebson, 1976-84

NATIONAL SCIENCE FOUNDATION

Dr. William A. Niering, 1968
Dr. Edward Chin, 1968-70
Dr. Richard C. Kolf, 1970-74
Dr. Edward H. Bryan, 1974-84

SMITHSONIAN INSTITUTION

Dr. I. Eugene Wallen, 1968-71
Dr. Francis S. L. Williamson, 1971-75
Dr. J. Kevin Sullivan, 1975-83
Dr. David L. Correll, 1983-84

U.S. NAVY

CDR J. A. D'Emidio, 1967-70
LCDR P. J. Parisius, 1970-71
Edward W. Johnson, 1971-84

DELAWARE

BG Norman M. Lack, 1967-68
Austin N. Heller, 1970-73
John C. Bryson, 1973-78
John E. Wilson, III, 1978-84

DISTRICT OF COLUMBIA

LTC Tom H. Reynolds, 1967
LTC Louis W. Prentiss, Jr., 1967-68
Roy L. Orndorff, 1968
Norman E. Jackson, 1968-72
Paul V. Freese, 1972-73
Robert R. Perry, 1973-75
William C. McKinney, 1975-76
Herbert L. Tucker, 1976-80
William B. Johnson, 1980-84

MARYLAND

Joseph H. Manning, 1967-71
John R. Capper, 1971-73
James B. Coulter, 1973-82
Dr. Torrey C. Brown, 1982-84

PENNSYLVANIA

Clifford H. McConnell, 1967-83
Nicholas DeBenedictis, 1983-84

VIRGINIA

Dr. William J. Hargis, Jr., 1967-83
Betty J. Diener, 1983-84

STEERING COMMITTEE FOR LIAISON AND BASIC RESEARCH

U.S. ARMY CORPS OF ENGINEERS

Michael A. Kolessar (Chairman 1968-70)
William E. Trieschman, Jr. (Chairman 1970-72)
Alfred E. Robinson, Jr. (Chairman 1972-84)

DEPARTMENT OF COMMERCE

Russell T. Norris, 1968-76
William Gordon, 1976-78
Dr. Robert L. Lippson, 1978-84

DEPARTMENT OF THE INTERIOR

Albert H. Swartz, 1968-71
John T. Gharrett, 1968-70
Dr. Oliver B. Cope, 1971-74
Dr. Daniel L. Leedy, 1974-76
Dr. W. Sherman Gillam, 1976-78
Dr. Glenn Kinser, 1978-84

ATOMIC ENERGY COMMISSION

Dr. Jeff Swinebroad, 1971-73
Dr. Ford A. Cross, 1973-75

DEPARTMENT OF ENERGY

Dr. W. Roland Taylor, 1975
Dr. Jackson O. Blanton, 1975-76
Dr. D. Heyward Hamilton, 1976-84

ENVIRONMENTAL PROTECTION AGENCY

Dr. Tudor T. Davies, 1979-80
Dr. David A. Flemer, 1980-84

NATIONAL SCIENCE FOUNDATION

Dr. William A. Niering, 1968
Dr. Edward Chin, 1968-70
Dr. Richard C. Kolf, 1970-74
Dr. Edward H. Bryan, 1974-84

STEERING COMMITTEE FOR LIAISON AND BASIC RESEARCH (cont'd)

SMITHSONIAN INSTITUTION

Dr. I. Eugene Wallen, 1968-71
Dr. Francis S. L. Williamson, 1971-75
Dr. J. Kevin Sullivan, 1975-83
Dr. David L. Correll, 1983-84

DELAWARE

BG Norman M. Lack, 1968
Norman G. Wilder, 1971-73
John C. Bryson, 1973-78
John E. Wilson, III, 1978-84

DISTRICT OF COLUMBIA

Norman E. Jackson, 1968-72
Paul V. Freese, 1972-73
Robert R. Perry, 1973-75
William C. McKinney, 1975-76
Herbert L. Tucker, 1976-81
James H. McDermott, 1981-84

MARYLAND

Frederick W. Sieling, 1968-75
Dr. L. Eugene Cronin, 1968-84
Dr. Donald W. Pritchard, 1968-84
Albert E. Sanderson, 1968-79
Howard Wilson, 1979-80
L. E. Zeni, 1975-84
Dr. Walter R. Taylor, 1979-84
Dr. Sarah J. Taylor, 1980-84

PENNSYLVANIA

Marshal S. Goulding, Jr., 1968-70
William N. Frazier, 1970-80
Steve Runkel, 1980-84

VIRGINIA

Dr. William J. Hargis, Jr., 1968-84

ATTACHMENT B-3

LISTING OF PUBLIC INVOLVEMENT ACTIVITIES

CHESAPEAKE BAY STUDY
SEQUENCE OF EVENTS - PUBLIC INVOLVEMENT ACTIVITIES

Date	Event	Participants	Topic
Jan 1967	Study Initiation	Corps	As noted
Feb 1967	Advisory Group Established	Corps	Corps establishes Adv. Group
Mar 1967	Interagency Meeting	Corps, Federal and State Agency	Potential Model testing
July 1967	Interagency Meeting	Corps, Bay-area Scientific Organ.	Prototypedata requirements
Sept 1967	1st Adv. Group Meeting	Corps, Adv. Group Members	Scope of Study
Nov 1967	Gov. of Md. offers land for model	Corps, State of Md.	As noted
Nov-Dec 1967	Initial Public Meetings	Corps, Public	Announce Study initiation
Dec 1967	Corps accepts land for model	Corps, State of Md.	As noted
Mar 1968	Adv. Group Meeting	Corps, Adv. Group Members	Establish Steering Com. & Task Gps
Apr-May 1968	1st Task Group Meetings (All)	Corps, Task Group Members	Scopes of Task Group Work
June-July 1968	Task Group Meetings (All)	Corps, Task Group Members	Work by Task Groups
July 1968	Prel. Plan of Study Published	Corps	As noted
June 1970	Plan of Study Published	Corps	As noted
Dec 1970	Advisory Group Meeting	Corps, Adv. Group Members	Work for Existing Conditions Report
Jan 1971	Steering Committee Meeting	Corps, Committee Members	Public participation; biological studies
Feb 1971	Task Group meetings (All)	Corps, Task Group Members	Work for Existing Conditions Report (ECR)
May 1971	Advisory Group Meeting	Corps, Adv. Group Members	Status report on study
Sept 1971	Task Group Meeting (WQ)	Corps, Task Group Members	Water quality work for ECR
Sept 1971	Steering Committee Meeting	Corps, Committee Members	Biological work
Sept 1971	Citizens Program for Ches Bay Mtg (CPCB)	Corps, Fed & State Agencies, Public	Public involvement in Ches Bay
May 1972	Advisory Group Meeting	Corps, Adv. Group Members	ECR and public involvement
Oct 1972	Meeting	Corps, CPCB representatives	Citizens Advisory Group
Nov 1972	Meeting	Corps, CPCB representatives	Citizens Advisory Group
April 1973	Release of film	Corps	Corps film on Study released - Planning for a
Better Bay"			
June 1973	Groundbreaking ceremony	Corps, local officials and public	Groundbreaking for Chesapeake Bay model
Oct 1973	Advisory Group Meeting	Corps, Adv. Group Members	Future conditions phase of the study
Dec 1973	Publish Existing Condition Report	Corps	As noted
March 1974	Advisory Group Meeting	Corps, Advisory Group Members	Scope and objectives of program
Apr-May 1974	Task Group Meetings	Corps, Task Group Members	Future conditions phase
May 1974	Symposium	Corps, CRC, Scientific Community	Effects of Tropical Storm Agnes on Bay
January 1975	Draft Agnes Study completed	Corps	As noted
May 1975	Adv. Group & Steering Com. Meeting	Corps, Adv. Group & Steering Com	Formulate model testing program
Oct 1975	Publish Final Agnes Report	Corps	As noted
Nov 1975	Advisory Group Meeting	Corps, Adv Group Members	Long term management of the Bay model
April 1976	Steering Committee Meeting	Corps, Steering Committee Members	Fist year of model testing
April 1976	Advisory Group Meeting	Corps, Adv. Group Members	Review Study progress

CHESAPEAKE BAY STUDY
SEQUENCE OF EVENTS - PUBLIC INVOLVEMENT ACTIVITIES (CONT'D)

Date	Event	Participants	Topic
May 1976	Dedication of Hydraulic Model	Corps, public	As noted; Model tours begin
June 1976	Series of public meetings	Corps, public	Advise public of proposed study plans
April 1977	Bi-state Conference on Ches. Bay	Corps; Federal, state, & local agencies; public	Condition of Ches. Bay
May 1977	Model open for Kent Island Days	Corps, public	Model open on weekends each year following
June 1977	Model open for Queen Annes Day	Corps, public	As noted
Oct 1977	Model open for Ches Appreciation Days	Corps, public	Model open each year for this observation
Dec 1977	Publish Future Conditions Report	Corps	As noted
Apr 1978	Advisory Group Meeting	Corps, Adv. Group Members	Review draft of Revised Plan of Study
June 1978	Steering Committee Meeting	Corps, Steering Com. Members	Review draft of Revised Plan of Study
June 1978	Meeting with CPCB	Corps, CPCB representatives	Public involvement in final study phase
June 1978	Meeting with Virginia officials	Corps, Virginia State officials	Public involvement in Virginia
Oct 1978	Publish Revised Plan of Study	Corps	As noted
Oct 1978	Dedication of T. Walter Denny Memorial	Corps, public	Memorial located at model
Nov 1978	Development of Joint Bay Display	Corps, EPA, States	Joint display discussing agency programs
Feb 1979	Bay Display completed	Corps, EPA, States	As noted
Aug 1979	Model Visitor Center complete	Corps	As noted
Oct 1979	Steering Committee Meeting	Corps, Steering Com. Members	Results of Model Testing
Oct 1979	NATO Committee Model visit	Corps, committee	As noted
Nov 1979	Educational Seminar at Model	Corps, CRC, scientific community	Status of Bay and uses for model
Nov 1979	Biota Seminar at Model	WESTECH, Corps, scientific community	As noted
Nov 1979	Meeting with CPCB	Corps, CPCB	Public invilvement in last stage of study
Dec 1979	Steering Committee Meeting	Corps, Steering Com. Members	Biota assessment contract
Jan 1980	Advisory Group Meeting	Corps, Advisory Group	Status of Study and Model
Feb 1980	Steering Committee Meeting	Corps, Steering Com Members	Biota assessment
Feb 1980	Reorganization of Task Group	Corps	As noted
March-Oct 1980	Model open for tours on weekends	Corps	As noted ,
Mar 1980	Biota Seminar at Colonial Beach, VA	WESTECH, Corps, scientific community	As noted
Apr 1980	Steering Committee Meeting	Corps, Steering Committee	Biota assessment
Apr 1980	Md-Va Joint Resolution on Model	States	As noted
June 1980	Steering Committee Mtg	Corps, Steering Committee	Biota assessment
Oct 1980	Adv Group & Steering Com. Mtg	Corps, Adv. Group & Steering Com.	Concrete problem at Model
Apr 1981	Meeting with CPCB	Corps, CPCB	Establishment of Ches. Bay Info Center
May 1981	Steering Committee Mtg	Corps, Steering Com	Status of Model and Study
Oct 1981	Biota Seminar at Naval Academy	WESTECH, Corps. scientific community	As noted
Dec 1981	Complete Model testing	Corps	As noted
June 1983	Publish News Circular	Corps	As noted
July 1983	Steering Committee mtg	Corps Steering Com	Biota assessment how Low Study
Aug 1983	Model closing	Corps	Model closed; tours stop
Dec 1983	Ches. Bay Conf	Corps, EPA, states	Condition of Ches. Bay

ATTACHMENT B-4

PERTINENT CORRESPONDENCE

ATTACHMENT B-4
PERTINENT CORRESPONDENCE

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NADPL 24 FEB 1967

Honorable Spiro T. Agnew
Governor of Maryland
Annapolis, Maryland

Dear Governor Agnew:

Section 312 of the River and Harbor Act of 1965 authorized and directed the Secretary of the Army acting through the Chief of Engineers to make a complete investigation and study of water utilization and control of the Chesapeake Bay Basin including the waters of Baltimore Harbor. The study will include but not be limited to the following: navigation, fisheries, flood control, control of noxious weeds, water pollution, water quality control, beach erosion, and recreation.

Included in the authorization is the construction, operation and maintenance of a hydraulic model of the Chesapeake Bay and an associated technical center to be located in the State of Maryland. The authorization further provides that the model may be utilized by other departments, agencies, or instrumentalities of Federal government and the States of Maryland, Virginia, and Pennsylvania in connection with any research, investigation, or study being carried on by them of any aspect of the Chesapeake Bay Basin.

(This study has been assigned to the District Engineer, Baltimore District, Corps of Engineers for accomplishment. However, the wide scope of this study makes it desirable to solicit cooperative participation of the several Federal departments and the three States having interests, and concerns with the Bay area as a water resource. It is presently considered that the following would be involved: the States of Maryland, Virginia, and Pennsylvania; and the Departments of Navy, Interior, Agriculture, Commerce, Transportation, Health Education and Welfare, Housing and Urban Development, Federal Power Commission, and the District of Columbia.

Honorable Spiro T. Agnew

I am aware that the States and agencies cited are involved in other cooperative water resource investigations and that attendance of the limited personnel available at frequent coordinating committee meetings is imposing a considerable burden. Nevertheless, I consider it essential for the successful conduct of this investigation to obtain the active participation of all the above agencies.

As an alternative to the establishment of a formal coordinating committee, I am proposing that each agency designate an individual who would serve as a direct working contact with the District Engineer to present the views and coordinate the participation of his agency, and that all such representatives would be convened as a group only at such times in the course of the investigation as is necessary to reach basic decisions and to review and comment on the course of the study. I believe this procedure will meet the objective of providing for full coordination and involvement of all the agencies with a minimum of time and effort.

Accordingly, I am requesting that you designate an individual to represent, as well as coordinate and direct the active participation of your organization throughout the course of the Chesapeake Bay study.

Sincerely yours,

F. P. KOISCH
Brigadier General, USA
Division Engineer

cc: NADEN w/d

BALTIMORE DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1715
BALTIMORE, MARYLAND 21203

NABEN-R

27 October 1967

NOTICE OF PUBLIC HEARING

CHESAPEAKE BAY STUDY
MARYLAND & VIRGINIA

TO WHOM IT MAY CONCERN:

Pursuant to Section 312 of the River and Harbor Act of 1965, adopted 27 October 1965, the Baltimore District Engineer has been directed to make a complete investigation and study of water utilization and control of the Chesapeake Bay Basin, including the waters of the Baltimore Harbor, and including, but not limited to, the following:

Navigation	Water pollution
Fisheries	Water quality control
Flood control	Beach erosion
Control of noxious weeds	Recreation

B-95

In order that all information pertinent to the problems may be considered in these studies, public hearings will be held throughout the study area, as follows:

Location	Time
Assembly Room, War Memorial Building War Memorial Plaza Gay and Lexington Streets Baltimore, Maryland	2:00 p.m., 29 November 1967
Newport News Courthouse 2501 Huntington Avenue Newport News, Virginia	7:30 p.m., 7 December 1967
Circuit Court Room Wicomico County Court House Salisbury, Maryland	2:00 p.m., 8 December 1967

All interested parties are invited to be present or represented at the above times and places, including representatives of Federal, State, county, and municipal agencies, and those of commercial, industrial, civic, highway, railroad, water transportation interests, and property owners concerned. They will be afforded full opportunity to express their views concerning the character and extent of water utilization, control, and development in the Chesapeake Bay Basin, and the solutions considered appropriate.

Oral statements will be heard, but for accuracy of record, all important facts and arguments should be submitted in writing, as the records of the hearing will be forwarded for consideration by the Department of the Army. Written statements may be handed to the undersigned at the hearing or mailed to him beforehand. It is requested that they be presented in quadruplicate.

Please bring the foregoing to the attention of persons known to you to be interested in the matter.

Frank W. Rhea
FRANK W. RHEA
Colonel, Corps of Engineers
District Engineer

EXECUTIVE DEPARTMENT

ANNAPOLIS, MARYLAND 21404

SPIRO T. AGNEW
GOVERNOR

November 2, 1967

Colonel Frank W. Rhea
District Engineer, Baltimore District
U. S. Army Corps of Engineers
P. O. Box 1715
Baltimore, Maryland 21203

Dear Colonel Rhea:

It is my understanding that your office is currently considering the merits of several alternative sites for construction of the hydraulic model of the Chesapeake Bay and for an associated technical center.

I hope that you will give serious consideration to the State-owned property at Matapeake, where a tract of land approximately 65 acres in size could be made available without cost to the Federal government. You are, I am sure, familiar with this area and the many advantages it offers. The Matapeake site is close to the Wye Institute; it is also serviced by airport and marine police facilities.

It is my personal feeling that much is to be gained by locating the model within sight of the Bay, since it will undoubtedly be a major attraction to tourists and groups of students who visit the City of Annapolis and the Wye Institute.

As Governor I wish to assure you that the State of Maryland will offer all possible cooperation to the Army Corps of Engineers in the planning and in the development of the model of the Chesapeake Bay.

Sincerely,

Spiro T. Agnew

THE COUNTY COMMISSIONERS
OF QUEEN ANNE'S COUNTY
CENTREVILLE, MARYLAND

WILLIAM E. COLEMAN, PRESIDENT
LEONARD E. SMITH
JULIUS GROLLMAN

LILLIAN C. CALLAWAY, CLERK
JAMES E. THOMPSON JR. ATTORNEY

December 21, 1967

Colonel Frank W. Rhea, USA
U. S. Army District Engineer
Baltimore District
Baltimore, Maryland

Dear Colonel Rhea:

On behalf of the citizens of Queen Anne's County as well as the members of this Board, we wish to express Queen Anne's County's appreciation of your interest and efforts during the past several months which have successfully culminated in the decision of the Corps of Engineers to locate the Chesapeake Bay Hydraulic Model at Matapeake.

We cannot over-emphasize either the importance of your contribution to the effort or the significance of the decision.

Very truly yours,

THE COUNTY COMMISSIONERS
OF QUEEN ANNE'S COUNTY

William E. Coleman
President

Leonard E. Smith

Julius Grollman

CC:c

[illegible] ATLANTIC
CORPS OF ENGINEERS
90 CHURCH STREET
NEW YORK 7, NEW YORK

21 FEB 1968

NADPL-F

Mr. Glenn T. Seaborg
Chairman, Atomic Energy Commission
Germantown, Maryland 20767

Dear Mr. Seaborg:

Section 312 of the River and Harbor Act of 1965 authorized and directed the Secretary of the Army acting through the Chief of Engineers to make a complete investigation and study of water utilization and control of the Chesapeake Bay Basin including the waters of Baltimore Harbor. The study will include but not be limited to the following: navigation, fisheries, flood control, control of noxious weeds, water pollution, water quality control, beach erosion, and recreation.

Included in the authorization is the construction, operation, and maintenance of a hydraulic model of the Chesapeake Bay and an associated technical center to be located in the State of Maryland. The authorization further provides that the model may be utilized by other departments, agencies, or instrumentalities of the Federal government and the States of Maryland, Virginia, and Pennsylvania in connection with any research, investigation, or study being carried on by them of any aspect of the Chesapeake Bay Basin.

This study has been assigned to the District Engineer, Baltimore District, Corps of Engineers, for accomplishment. However, the wide scope of this study makes it desirable to solicit cooperative participation of the several Federal departments and the four States having interests and concerns with the Bay area as a water resource. It was considered that the following would be involved: the States of Maryland, Delaware, Virginia, and Pennsylvania; and the Departments of Navy, Interior, Agriculture, Commerce, Transportation, Health Education and Welfare, Housing and Urban Development, Federal Power Commission, and the District of Columbia.

I am aware that the States and agencies cited are involved in other cooperative water resource investigations and that attendance of the limited personnel available at frequent coordinating committee meetings was imposing a considerable burden. Nevertheless, I considered it essential for the successful conduct of this investigation to obtain the active participation of all the above agencies.

NADPL-F
Mr. Glenn T. Seaborg

21 FEB 1968

As an alternative to the establishment of a formal coordinating committee, I proposed that each agency designate an individual who would serve as a direct working contact with the District Engineer to present the views and coordinate the participation of his agency, and that all such representatives would be convened as a group only at such times in the course of the investigation as is necessary to reach basic decisions and to review and comment on the course of the study. In this connection, an Advisory Group, with representatives from the above cited States and agencies, was organized on 27 September 1967. I believe this procedure meets the objective of providing for full coordination and involvement of all the agencies with a minimum of time and effort.

It has been suggested by the Committee on Multiple Uses of the Coastal Zone of the National Council on Marine Resources and Engineering Development, authorized by the Act of 1966 (P.L. 89-454), that your agency may wish to designate a representative. Accordingly, I am inviting you to designate an individual to represent, as well as coordinate and direct the active participation of your organization throughout the course of the Chesapeake Bay Study.

Sincerely yours,

F. P. KOISCH
Brigadier General, USA
Division Engineer

cc: ✓NADEN-R
ENGCW-PD
NADEN, w/d

Same letter sent to:
Dr. S. Dillon Ripley
Secretary, Smithsonian Institution
Smithsonian Institution Building
The Mall
Washington, D.C. 20560

+ Leland Haworth, NSF

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS
P O BOX 1715
BALTIMORE, MARYLAND 21203

NABEN-B

27 July 1970

TO ALL PARTICIPANTS ON THE CHESAPEAKE BAY STUDY

I am pleased to inclose the June 1970 version of the Chesapeake Bay Plan of Study and would appreciate receiving any comments or corrections.

Since my letter of 2 March 1970, the study has taken a step forward. An inter-agency support agreement was made with the Coast and Geodetic Survey for the installation of the permanent tide gage network in the bay. Contracts were also awarded to the Johns Hopkins University and the University of Maryland for hydrographic studies on the Potomac River, and to the Virginia Institute of Marine Science for studies on the Rappahannock River and Mobjack Bay. Negotiations are nearing completion with the State of Maryland for the acquisition of the property at Matapeake, Maryland.

On 19 June 1970, P.L. 282 was signed by the President which increased the authorization of the Chesapeake Bay Study to $15,000,000. Although the study is programmed in the President's Budget for $330,000 in FY 1971, the Appropriations Bill, which has been passed by the House of Representatives, includes $1,330,000 for the study and model. In addition, there are no restrictions in the bill on the design of the Hydraulic Model complex. If these additional funds are approved, we should be able to reactivate the task groups and begin work on both the resource study and the model.

After funds are appropriated, which should be about October, I will schedule meetings of the task groups and Advisory Group.

Sincerely yours,

W. J. LOVE
Colonel, Corps of Engineers
District Engineer

1 Incl
As stated

NABPL-C

15 January 1971

TO ALL TASK GROUP CHAIRMEN, CHESAPEAKE BAY STUDY

Our allotment of funds for Fiscal Year 1971 for the Chesapeake Bay Study is sufficient to reactivate this most important study. In December, I held a meeting of the Advisory Group which was also attended by members of the Steering Committee. The purpose of the meeting was to agree upon study objectives and the overall concept of the study program so that work on the specific study items could be renewed.

I have inclosed for your information, descriptions of the study objectives and the general explanation of the conduct of the study which were agreed upon by the Advisory Group. Your attention is specifically invited to the section on outputs of the study. Six distinct reports will be published, each following a phase of the study. The first, a report on existing conditions, is scheduled for completion at the end of Fiscal Year 1972. It is imperative that immediate action be taken to initiate the items of work required to prepare this report.

Inclosed is a detailed activities sequence diagram showing specific items of work which have been identified as being necessary to accomplish the study. Write-ups on the work packages, which are scheduled for accomplishment in Fiscal Year 1971 and early in Fiscal Year 1972, are inclosed.

The first page of the work packages provides a description of the information contained in each work package. I request that you convene your work group to discuss the aforementioned work items and be prepared to report on the results of your meeting to the Advisory Group in February. It is imperative that we reach agreement on these items so that the appropriate interagency agreements can be executed and the actual work be initiated. Special attention should be paid to the description of the work, what contributions the agencies represented on your Work Group can make to each work package, whether the required information is readily available, and the adequacy of the time and fund requirements. The agency which has been tentatively

NABPL-C
TO ALL TASK GROUP CHAIRMEN, CHESAPEAKE BAY STUDY

designated as having the responsibility for a work package is for management purposes only; all members of the task group will undoubtly contribute to each work package. The decision on which agency should be responsible for management of each work item should be made at the task group meeting. Also, it is requested that you review all the work packages, not just those of your task group.

In addition to consideration of the work packages and the sequence diagram, the task groups should consider how the data will be presented in the existing conditions report. Also, the type and extent of physical, biological, chemical, and economic data required for work items related to the future conditions report should be determined so we can further identify the needs for our data collection program.

A current list of the members of your task group is inclosed. I have sent a copy of this letter and the inclosures to each member shown on the list.

I am sure that the Corps of Engineers' representative on your task group will be able to answer specific questions on the information inclosed.

Sincerely yours,

4 Incl
As stated

W. J. LOVE
Colonel, Corps of Engineers
District Engineer

rc: Planning Division

2

RECREATION TASK GROUP MEETING

DATE: 3 February 1971

CHAIRMAN: Mr. Frank M. Basile, Bureau of Outdoor Recreation

ATTENDANCE

Frank M. Basile	Bureau of Outdoor Recreation
Richard T. Huber	Bureau of Sport Fisheries & Wildlife
David A. Kimball	National Park Service
Harold I. Lessem	National Park Service
Harold E. Scholl	Soil Conservation Service
Frederick D. Knapp, Jr.	Water Quality Office, EPA
Capt. Lester A. Levine	U.S. Coast Guard
Alfred E. Robinson	Corps of Engineers, Baltimore District
Dr. James H. McKay, Jr.	Corps of Engineers, Baltimore District
Noel E. Beegle	Corps of Engineers, Baltimore District
John C. Diering, Jr.	Corps of Engineers, Baltimore District
Charles G. Stone	Corps of Engineers, N. Atlantic Division
Marshall M. Cook	Md. Fish & Wildlife Administration
William A. Parr	Maryland Dept. of Forests & Parks
Albert E. Sanderson, Jr.	Maryland Dept. of Water Resources
William J. Hopkins	Delaware Dept. of Natural Resources & Environmental Control
George E. Fogg	Pa. Dept. of Environmental Resources
Rob R. Blackmore	Virginia Comm. of Outdoor Recreation

SUMMARY

1. The group discussed the recreation work packages and agreed existing Federal and state recreation inventories would be updated to a base year of 1970.

2. The inventories will reflect only the four basic Bureau of Outdoor Recreation (BOR) recreation activities - swimming, boating, picnicking and camping - rather than all activities shown in the plan of study.

3. BOR plans to use a new Environmental Quality Rating system as part of the existing conditions report.

4. The study area, as defined at this meeting, included economic subregions 1 thru 4, plus the Delaware portion of subregion 5.

5. The sequence diagram and time schedule for the recreation work was considered appropriate; however, BOR would prefer combining the work packages on demands (R-3) and needs (R-4) into a single demand-supply-needs analysis.

FLOOD CONTROL, NAVIGATION, EROSION, AND FISHERIES TASK GROUP

DATE: 10 February 1971

CHAIRMAN: Mr. John P. O'Hagan, Corps of Engineers, Baltimore District

ATTENDANCE

John W. Baumeister	Water Quality Office, EPA
Noel E. Beegle	Corps of Engineers, Baltimore District
David K. Bowen	Soil Conservation Service
Morris Colen	Corps of Engineers, N. Atlantic Division
W. Wayne DeMoss	Pa. Dept. of Environmental Resources
Stanley A. Feitler	U.S. Bureau of Mines
George E. Hoerichs	Maryland Fish & Wildlife Administration
Edgar H. Hollis	Maryland Fish & Wildlife Administration
Richard T. Huber	Bureau of Sport Fisheries & Wildlife
Edwin B. Joseph	Virginia Institute of Marine Science
Ted S. Y. Koo	University of Maryland
Carl D. Matthias	Corps of Engineers, Norfolk District
G. Liberatore	Naval Ship Research & Development Lab
Herbert Linthicum	Corps of Engineers, Baltimore District
Captain W. A. Montgomery	U.S. Coast Guard
George J. Moorehead	D. C. Department of Sanitary Engineering
John P. O'Hagan	Corps of Engineers, Baltimore District
Turbit H. Slaughter	Maryland Geological Survey
Thomas P. Whelley	Corps of Engineers, Baltimore District

SUMMARY

1. The group discussed each of the task group's work packages with regard to content and the adequacy of cost and time estimates. The group generally found the work packages were sufficient; however, the National Marine Fisheries Service (NMFS) took exception to the Corps of Engineers preparing work packages N-2 and N-3, stating that the Department of Commerce was in a better position to collect this data. It was suggested that the NMFS advise the District Engineer regarding its capability to perform the aforementioned work.

2. The group agreed that the inventory data should have a base year of 1970, and that the adoption of standardized mapping would be advisable.

3. Regarding better public response to the study, the group felt newsletters, public meetings and personal contacts, were important, but that television coverage was the best method of making the general public aware of the study.

ECONOMIC PROJECTIONS TASK GROUP MEETING

DATE: 12 February 1971

CHAIRMAN: Mr. Henry L. DeGraff, Office of Business Economics

ATTENDANCE

Donald W. Roeseke	Corps of Engineers, Baltimore District
Noel E. Beegle	Corps of Engineers, Baltimore District
Paul Danis	Corps of Engineers, Baltimore District
Henry L. DeGraff	Dept. of Commerce, Office of Business Economics
Roger Matson	Dept. of Commerce, Office of Business Economics
Frederick Bell	Dept. of Commerce, National Marine Fisheries Service
Dr. P. Thomas Cox	Dept. of Agriculture, Economic Research Service
Stanley Feitler	Dept. of Interior, Bureau of Mines
Frederick D. Knapp, Jr.	Water Quality Office, EPA
Robert Griffis	Commonwealth of Virginia, Division of Planning
Mr. Ellis Harned	Commonwealth of Pennsylvania, State Planning Board

SUMMARY

1. Discussion at the meeting centered on work packages EP-1, EP-2, and EP-3, as described in the preliminary draft "Chesapeake Bay Study Work Packages" distributed on 15 January 1971.

2. The principle area of discussion regarding EP-1 was the definition of the study area. It was generally agreed that the study area should be limited to the Bay area, recognize state planning districts, and eliminate the Philadelphia SMSA while including the Wilmington SMSA. It was further agreed OBE would draft a study area proposal for review and comment by all task groups.

3. Discussion of EP-2 centered on the use of the OBERS projections. It was generally agreed that OBE and ERS would have major responsibility for preparation of this package and that the primary task would be disaggregating OBERS projections to the study area defined in EP-1.

4. A meeting of the Economic Projections Task Group has been scheduled for 25 May 1971.

FISH AND WILDLIFE COORDINATION GROUP MEETING

DATE: 9 March 1971

CHAIRMAN: Mr. Herbert A. Hunter, Bureau of Sport Fisheries & Wildlife, Department of the Interior

ATTENDANCE

Herbert A. Hunter	Bureau of Sport Fisheries & Wildlife
Richard T. Huber	Bureau of Sport Fisheries & Wildlife
Robert L. Schueler	Natural Marine Fisheries Service
Marvin F. Bousso	Natural Marine Fisheries Service
John W. Baumeister	Water Quality Office, EPA
Arthur D. Bradford	Pennsylvania Fish Commission
J. F. McInteer, Jr.	Virginia Commission of Game & Inland Fisheries
Morris L. Brehmer	Virginia Institute of Marine Science
Charles A. Lesser	Dept. of Natural Resources & Environmental Control, State of Delaware
Fred W. Sieling	Maryland Fish & Wildlife Administration
Edwin M. Barry	Maryland Department of Natural Resources
William E. Trieschman, Jr.	Corps of Engineers, Baltimore District
Alfred E. Robinson, Jr.	Corps of Engineers, Baltimore District
John P. O'Hagan	Corps of Engineers, Baltimore District
Noel E. Beegle	Corps of Engineers, Baltimore District

SUMMARY

1. The group agreed that this coordination group was still necessary in that it provides a mechanism for coordination between all Federal and state fish and wildlife agencies.

2. The representatives from the Bureau of Sport Fisheries and Wildlife (BSFW) and the National Marine Fisheries Service (NMFS) agreed that the responsibilities and working relationships of the two agencies would remain as they were prior to the Department of the Interior's reorganization. With this consideration the work package assignments were considered appropriate. Both BSFW and NMFS indicated they had capability to proceed this fiscal year with the work designated in the various fish and wildlife work packages.

3. It was agreed that the report titled "Fish & Wildlife Resources as Related to Water Pollution" will serve as the basic document to be updated for the fish and wildlife inventories. All data will be updated to a base year of 1970.

WATER QUALITY AND SUPPLY, WASTE TREATMENT, AND NOXIOUS WEEDS TASK GROUP MEETING

DATE: 17 February 1971

CHAIRMAN: Dr. James H. McKay, Jr. Corps of Engineers, Baltimore District

ATTENDANCE

Johan A. Aalto	Water Quality Office, EPA
Thomas H. Pheiffer	Water Quality Office, EPA
R. Kenneth Tinsley	Water Quality Office, EPA
W. F. White	U.S. Geological Survey
Dr. Jeff Swinebroad	Atomic Energy Commission
Robert L. Schueler	National Marine Fisheries Service
Stanley A. Feitler	U.S. Bureau of Mines
Comm. Harold B. Summey	U.S. Coast Guard
Arnold Speiser	D. C. Department of Sanitary Engineering
Albert E. Sanderson, Jr.	Maryland Department of Water Resources
Noel C. Valenza	Maryland Department of Health
A. W. Hadder	Virginia State Water Control Board
Dr. James H. McKay, Jr.	Corps of Engineers, Baltimore District
Harold L. Nelson	Corps of Engineers, Baltimore District
John C. Diering, Jr.	Corps of Engineers, Baltimore District

SUMMARY

1. The group discussed each of the task group's work packages, and there was general agreement on the content and time and cost estimates.

2. It was agreed standardized mapping would be advisable and that the study area should be limited to the Bay area proper where practicable.

3. The various agencies represented at the meeting indicated that while they could provide the Corps with existing data, they had no capability for additional work this fiscal year.

NABPL-P 12 May 1971

Memo to the File

SUBJECT: Meeting with Officials from the Environmental Protection Agency Regarding the Chesapeake Bay Study

1. On 11 May 1971 a meeting was held in the Baltimore District Office to discuss the role of the Water Quality Office (WQO) of the Environmental Protection Agency in the Chesapeake Bay Study. A list of the persons attending is included as inclosure 1.

2. The meeting was held at the request of WQO to discuss the water quality work packages (content and funding); the data which was available in the offices of WQO and the various state water quality agencies; and the applicability of a mathematical model currently under study by WQO. The following comments were considered noteworthy.

a. Mr. Phiffer indicated Mr. Lloyd Gebhart, Interim Regional Coordinator, WQO, would be designated as an acting member on the Advisory Group pending further appointments in the WQO. Mr. Phiffer also indicated WQO would like to be represented on the Steering Committee. The undersigned suggested this desire be included in the letter to the District Engineer regarding Mr. Gebhart's appointment.

b. Mr. Horn discussed the "STORET" data retrevial system that is currently in use in WQO and several of the state agencies. This office indicated studies of various data retrevial systems were underway and it was agreed Mr. Crews would discuss the "STORET" system in depth with Mr. Horn later this week. Mr. Horn urged the "STORET" system be used for the water quality inventories with the data to be transferred to a more comprehensive system at a later date.

c. Mr. Sloan discussed the mission of the Maryland Environmental Service and the sampling program currently underway in the Baltimore Harbor. Mr. Sloan explained that in addition to the county water and sewer plans both metropolitan regional and basin 5-year treatment plans are being prepared. The basin plans will be prepared by the State of Maryland (Dept. of Water Resources), while the metropolitan plans will be prepared by the community (A/E contract). The plans will include recommendations for an early action plan (1980) and a long range plan (2000 - 2020). The plan for the Baltimore Regional area is scheduled for completion in July 1972.

d. In the afternoon session, Mr. Crim made a brief presentation on the mathematical model of the Chesapeake Bay being developed by WQO. While a detailed explaination of the capability of the math model was not made, it appears a math model once verified with prototype and

NABPL-P 12 May 1971

Memo to the File

SUBJECT: Meeting with Officials from the Environmental Protection Agency Regarding the Chesapeake Bay Study

hydraulic model data would be a valuable tool for the study. WQO was provided a copy of the type and extent of the field data currently being collected under contract for model verification. This information was provided to avoid WQO collecting duplicate data for verification of their math model.

e. Work packages WQ-1 through WQ-6 were discussed. Mr. Crews outlined the work that had been accomplished by this office to date on WQ-1, 2, 3, and 5, and sample data formats were provided WQO. WQO intends to review further the time, cost and content of the work packages; determine the data available in the state agencies; and make a work proposal to this office. Mr. Horn said WQO agreed in general with the existing work packages. It appears this office will complete work packages WQ-1, 2, 3, and 5, with WQO accomplishing the work in WQ-4 and 6.

f. In response to a question by Mr. Horn, WQO was assured monies would be available for water quality work next fiscal year; however, WQO should make a work proposal based on work identified in the work packages. While WQO was eager to collect water quality samples in the field this summer, they were cautioned strong justification would be required for Corps' funding of this type of activity prior to completion of the existing conditions report.

g. This office agreed to furnish WQO copies of the research planning study ("The Chesapeake Bay") proposal submitted to the National Science Foundation.

3. The meeting was adjourned at 1530 with WQO agreeing to furnish this office as soon as practicable a proposal for work to be accomplished by their office.

1 Incl
As stated

BEEGLE

CITIZENS PROGRAM FOR THE CHESAPEAKE BAY

Box 38
Solomons, Maryland 20688

June 29, 1971

B-103

Col. W. J. Love
District Engineer
U.S. Army Corps of Engineers
Baltimore, Maryland 21201

Dear Col. Love:

We would like to invite you to participate in a unique effort to learn what the citizens of the Chesapeake Bay region wish for the Bay in the future.

A group of citizen organizations indicated to the left as sponsors are inviting about 175 organizations to send one or two representatives each to a Conference at College Park on September 16, 17 and 18. No state or federal agencies will be represented as such. We hope to draw from the group expressions of opinions and preference which can be of unique value to your agency and others. The Steering Committee has been aware that it is extraordinarily difficult to obtain an expression of the public will and the public wish. We hope that this Conference can contribute toward that objective.

Your role in the Conference is, however, of the greatest importance. You are most cordially invited to designate an observer who will be welcome in all parts of the Conference and may serve as a source of information. We hope he or she will obtain useful information even before the report from the Conference is completed. Second, we request that you send me a set of the questions and choices on which you would like to obtain the opinion of "the public." We are assembling such questions from a rather wide group of state and federal agencies to incorporate them in a questionnaire to be completed by all registrants at

the Conference. This is a difficult task and we will obtain the assistance of professional people in the field of questionnaire design and presentation. Obviously your questions may be restated and combined with others in the final questionnaire. We will send you a copy of that questionnaire and a full summary of the opinions expressed at the Conference.

We feel some real regret that we can't invite you to send a large group because of your unique knowledge and responsibilities. That has been done at previous conferences, however, and we believe that the distinctive character of this one, which limits it to citizen expression and opinion, is worth this special emphasis.

The participants in the Conference may, or may not, decide to develop some further expression of their opinions and a citizens' plan. In any case, we hope that the total Conference and its products will be of constructive value to you and your associates who carry the real burden of controlling the present uses and assuring the best future uses of this great resource.

I would especially appreciate designation of an observer and receipt of your suggested questions by 15 July, if possible. Further suggested questions can be submitted at a later date if you wish.

Cordially,

L. Eugene Cronin

L. Eugene Cronin
Project Director

mgm

NABPL-F 19 September 1971

Memo to the Files

Subject: Citizens Program for the Chesapeake Bay

1. During the period 16-18 September the undersigned attended a citizens' conference to discuss the Chesapeake Bay held at the Adult Education Center of the University of Maryland. This conference was coordinated by the Natural Resources Institute of the University of Maryland under the direction of Dr. L. Eugene Cronin, and was financed in part by a grant from the U.S. Office of Education. Additional funding was provided by the sponsers which include the Central Atlantic Environment Service, Chesapeake Bay Foundation, Conservation Council of Virginia, Izaak Walton League of America, and the League of Women Voters. The purpose of the conference was to learn what the citizens of the bay region wish for the bay in the future, and to discuss whether the variety of bay uses could be maintained for the next 100 years without destroying the bay's quality. In addition, consideration was to be given to formation of a citizens organization for continued action regarding the bay. A list of conference participants is included as inclosure 1.

2. It should be noted that the undersigned as well as those individuals representing the other Federal and state agencies were asked to participate in the conference only as observers who would serve as a source of information on Federal and state programs. As a result no formal presentations were made by the observers; however, the discussion periods, social hours and meals, provided ample opportunity to discuss the Corps Chesapeake Bay Study. Numerous questions were raised regarding the Corps study particularly with regard to the hydraulic model.

3. Reference is made to the conference agenda which has been included as inclosure 2. The following comments are provided regarding the program events indicated on the agenda.

a. Following brief opening remarks by the conference chairman, Mr. Edward Aiton, and chancellor C. E. Bishop, an excellent history of the bay region was presented by Dr. Carl Humelsine. Dr. Humelsine's presentation was highlighted by one of the most comprehensive and high quality slide presentations this writer has seen.

b. The "challenge" for the conferees was next provided by Mrs. Beverly Holmberg and Mr. Arthur Sherwood. Both speakers tended to over dramatize the environmental condition of the bay in order to spur the attendees to "save our bay". The objectives of the conference were then stated as mentioned in paragraph 1.

c. The afternoon session was started with Dr. L. Eugene Cronin's presentation entitled "The Scientific Viewpoint". Dr. Cronin's presentation is included in it's entirity as inclosure 3. Dr. Cronin was followed by Dr. Steve Hanke who viewed the bay's problems from an economist's standpoint. Unfortunately, Dr. Hanke's theories on "optimal pollution" were not understood by the majority of the attendees in this writer's opinion.

d. The next major presentation was made by Mr. Norman G. Wilder, Delaware Wildlands and Wildlife Federation, who gave a chronology on the events leading up to the recent passage of Delaware's shoreline use plan for the Delaware Day. It should be noted, Mr. Wilder is a member of the Corps Chesapeake Bay Study's Steering Committee.

e. After dinner, speakers were "Commodore" Frank Hennsey, public relations representative for the National Brewing Company, who narrated a film presentation on the bay, and Mr. Frank Gregg who emphasized that while the Federal and state government can develop an independent comprehensive program for a basin, the responsible citizens' group should assist in the development of the program and also support the implementation of the program. Mr. Gregg also discussed the type 2 study program of the Water Resources Council and was quite generous in his praise for the Corps as a planning agency.

f. For the second day of the conference, discussion groups were formed to talk about the problems and desired solutions to the various water resources needs. Each group also discussed what future action, if any, should be taken by a citizen's group. Following the discussion each group prepared a report consisting of various findings and recommendations which were presented to the conference on the third day. A summary of these recommendations is included as inclosure 4.

g. The evening presentations on the second day of the conference were highlighted by a film presentation and talk by Mr. Joseph Bodovitz, San Francisco Bay Study Commission. Mr. Bodovitz outlined the problems in San Francisco Bay and the steps which have been taken by both government and citizens groups to solve these problems. Mr. Bodovitz was very generous in his praise of the Corps planning effort in the San Francisco Bay area and the responsiveness of the Corps with regard to changes in conservation and environmental policies. A pamphlet outlining the San Francisco Bay Plan and the Bay Conservation and Development Commission is included as inclosure 5.

h. The primary events on the last day of the conference were the recommendations of the discussion groups outlined in paragraph 3f above, the results of a questionaire distributed at the beginning of the conference, and consideration of alternatives for future action. A sample questionaire which indicates the results of the conference survey is included as inclosure 6. Regarding future action, the alternatives considered are given in inclosure 7. After some discussion alternative three was adopted by the attendees with the pencil changes as indicated. Following this action the conference was adjourned.

4. In addition to the above, the following general comments are offered regarding the conference.

a. From an examination of the attendance list, it is apparent that the conferees were more representative of the ecologically oriented sector rather than all bay interests. This fact should not be overlooked in reviewing the discussion group recommendations and questionaire results.

b. With few exceptions the attitude of the conferees toward the overall program of Corps was good. Some criticism was directed by several individuals at stream channelization projects; spoil disposal practices at navigation projects; and several proposed projects to include Salem Church Dam (Norfolk District) and the six dams proposed for the Potomac River Basin. With regard to the Corps Chesapeake Bay Study in particular, support for the early construction of the model and shelter was very strong. There was, however, a definite lack of knowledge as to the scope and objectives of the resource study. It was also apparent that some individuals view the hydraulic model as providing answers to <u>all</u> bay questions. Both of the above misconceptions point to the need for a strong public information program.

c. Regarding the dissemination of information on the study and model, the undersigned questioned the officials of several of the represented organizations to obtain mailing lists and distribution preferences. Some organizations would rather provide information to their members via their own newsletters based on material furnished to the headquarters, while others operating on a smaller budget would prefer a direct mailing of a Corps information pamphlet or newsletter.

d. Regarding formation of a citizens planning committee, this writer feels the establishment of a citizens advisory group is essential in order to gain a more direct and meaningful citizen input to the Corps study. Two of the alternatives open to this office include (1) relying on the conference steering committee to organize a citizens group which

will be representative of all bay interests and then depending on that group for input to and review of the Corps study and (2) developing a list of candidates and inviting those selected, following a review by the Advisory group, to participate in a Citizens Advisory Group for the Corps study. Regardless of the alternative selected the timing appears right to pursue the public information and participation programs very vigorously.

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Beegle
BEEGLE

(Registration as of September [illegible], 1971)

CITIZENS PROGRAM FOR THE CHESAPEAKE BAY

PARTICIPANTS IN THE WORKING CONFERENCE

UNIVERSITY OF MARYLAND

SEPTEMBER 16-18, 1971

	NAME	AFFILIATION
	Mrs. Agnew, Marion	Northern Virginia Conservation Council
*	Aiton, Edward W.	Izaak Walton League (Md.)
	Allen, Leo	Fishermans Clean Water Project
	Allison, James T.	Md. Dept. of Water Resources
	Mrs. Barnes, George	Potomac River Assoc. of St. Mary's County
	Beegle, Noel E.	U.S. Army Engineer District (Balt.)
	Bergoffen, William W.	Natural Resources Institute
	Mr. & Mrs. Blake, Homer	National Campers & Hikers Assoc.
	Blumberg, Barry D.	Baltimore Junior Assoc. of Commerce
	Bodovitz, Joseph	San Francisco Bay Study Commission
	Mrs. Bohler, Jack C.	Junior League of Norfolk, Inc.
	Mrs. Bright, J. Paul	Federated Garden Clubs of Maryland, Inc.
	Burgess, Robert H.	Mariners Museum, Newport News, Va.
	Buxbaum, Robert E.	Natural History Society of Md.
	Buxton, J.T.	Virginia Chamber of Commerce, Norfolk
	Canada, Joe	Republican Party of Virginia
	Capper, John R.	Chesapeake Bay Affairs
	Carothers, Charles G. III	U.S. Department of Interior
	Mrs. Carren, Lorraine	Md. Wilderness Assoc.
	Mrs. Carter, Virginia	Maryland Wetlands Committee
	Charsee, Gould	Ecology Action
	Ciucci, Joseph V. Jr.	Amer. Inst. of Architects, Virginia Chapter
	Coch, Linda	Holland College, Virginia
*	Mrs. Cole, Gloria	League of Women Voters, Md.
	Mrs. Comstock, George W.	Maryland League of Women Voters
	Conklin, Ken	Harry Lundberg Seamanship School
	Crawford, Robert C.	National Science Foundation
	Mrs. Cronin, Alice	C.P.C.B. Steering Committee
	Cronin, L. Eugene	Natural Resources Institute
	Crosswhite, Chris	Ecology Action
	Cunneen, Wallace V.	Izaak Walton League, Rossmoor Chapter
	Cyr, Leo	Bay Fishing & Boating Committee
	Delmar, Eugene A.	MICEP - AIA
*	Dennis, Robert T.	Central Atlantic Environment Service
	Mrs. Dent, Gwen	American Assoc. of University Women, Va.
	Dowd, Richard	
	Mrs. Eastman, Thomas	Junior League of Baltimore, Inc.
	Fisher, John C.	IWLA - Md. State Division
	Mrs. Ford, Ellen	Junior League of Washington, D.C.
	French, Warren B., Jr.	Republican Party of Virginia
	Mrs. Gallagher, Germaine	League of Women Voters (Md.)
	Gentry, Charles	Environmental Protection Agency
	Mrs. Gilson, Gabriel	Maryland Wilderness Assoc.
	Golden, Clifton W.	Virginia Wildlife Federation
	Gottlieb, Bertram	Transportation Institute
	Mrs. Granger, Christopher	Conservation Education Council of Md.

"We the People and the Bay . . . 1776-1976"

NAME	AFFILIATION
Gregg, Frank	New England River Basins Commission
Hanke, Steve H.	The Johns Hopkins University
Harris, Walter	Conservation Education Council of Md.
Mrs. Hartwell, Elizabeth	Northern Virginia Conservation Council Citizens Council for a Clean Potomac
Harvey, Holger H.	Delaware Wildlands
Mrs. Hastings, Peggy	Council for Environmental Quality
Hennesey, Frank	"Commodore of the Chesapeake"
Mrs. Hennesey, Frank	
Mrs. Holmberg, Beverly	League of Women Voters (Va.)
Mr. & Mrs. Humelsine, Carlisle L.	Colonial Williamsburg
Huss, Harry O.	Maryland Society of Professional Engineers
* Mrs. Jackson, Dodie	Junior League of Hampton Roads, Inc.
Jennings, Joseph	Bay Fishing & Boating Committee
Mrs. Jensen, Belva L.	Charles County Community College
Johnson, Carl J.	Interstate Commission on Potomac River Basin
Mrs. Johnson, A. Reid	Federated Garden Clubs of Maryland
Johnson, Wheeler	Outdoor Writers Assoc. of America
Julian, William H.	Bureau of Sport Fisheries & Wildlife
Kelley, Steven	The Nature Conservancy
Kellam, Alec	
Mrs. Kellam, E. Polk	The Garden Club of Virginia
Kindle, Earl C.	Old Dominion University
Lankford, T.T.	Bethlehem Steel Corporation
Levin, Alan	E.P.A.
Lewis, Lloyd	Norfolk Ledger-Star

NAME	AFFILIATION
Liddick, K.E.	Bethlehem Steel Corporation
Longwell, John R.	Md. Dept. of Water Resources
Mrs. Magargle, Helen	Audubon Naturalist Society for Central Atlantic States, Inc.
Mahoney, William W.	Maryland Petroleum Assoc.
Mrs. Mathes, Ruth	Central Atlantic Environment Service
Matthias, Carl D.	U.S. Army Corps of Engineers (Norfolk)
McGinnis, Frank	Oyster Growers and Packers
Merrill, Arthur S.	NOAA
* Meyer, Donald B.	American Oil Company
Miller, Alan J.	National Audubon Society
Miller, Fred	Conservation Education Council
Murray, E. Churchill	Chesapeake Environmental Protective Assoc.
Mrs. Mullen, Gail	Citizens Against Pollution
Myers, Don	Johns Hopkins Hospital
Neale, William F.	ASCE, Md. Section
Odland, Russel K.	American Chemical Society, Va. Section
Pankowski, Ted	Conservation Council of Virginia
Pheiffer, Thomas H.	E.P.A. (Va.)
Mrs. Phillips, Robert L.	Junior League of Hampton Roads
Pittman, Melvin A.	Old Dominion University
* Prier, Bob	Chesapeake Bay Seafood Industries Assoc.
Quick, George A.	Association of Maryland Pilots
Rogers, S.M.	Marine Resources Commission (Va.)
Roy, Rob	The Johns Hopkins University
* Mrs. Rutledge, Ann	League of Women Voters (Md.)

NAME	AFFILIATION
Mrs. Scott, Barbara A.	Maryland League of Women Voters
Mrs. Skeppstrom, Joan C.	Citizens Against Pollution
Sherwood, Arthur	Chesapeake Bay Foundation
Sieling, Fred	Fish & Wildlife Administration (Md.)
Smith, Gary A.	Md. Dept. of Transportation
Smith, John P.	Natural Resources Institute
Mr. & Mrs. Smith, Warren N.	Maryland Charterboat Assoc.
Sommerville, Alan J.	Dept. of Environmental Resources (Pa.)
Mrs. Stern, Robert L.	Virginia League of Women Voters
Mrs. Stockett, Charles	League of Women Voters, Md.
Mrs. Taylor, Ralph E.	Maryland Federation of Women's Club
Thompson, Robert	Izaak Walton League (Md.)
Thurston, Jack T.	Northern Neck of Va. Audubon Society
Tiller, R.E.	Charles County Community College
Tribukait, Robert F.	Md. Dept. of State Planning
Valliant, Jeremiah	Boat Act Advisory Committee U.S. Power Squadrons
Vinnicombe, Edward J.	Citizens Committee on Modernization of Maryland Courts & Justice, Inc.
Wallace, David	Wallace, McHarg, Roberts & Todd
Mrs. Wallace, Elizabeth M.	Shellfish Institute of North America
Walsh, Donald E.	Old Dominion University
Ward, Herbert H.	Upper Chesapeake Bay Watershed Assoc.
Wentworth, Marchant	Ecology Center
Wilder, Norman G.	Delaware Wildlands & Wildlife Federation
Williams, Fielding	Governor's Council on the Environment (Va.)

NAME	AFFILIATION
Wills, George	Md. Environmental Trust
Wilmot, George	Southern Md. Audubon Society
Wineman, Andrew	N.A.S.A.
Wisner, Tom	Chesapeake Biological Laboratory, NRI
Mrs. Wright, J.M.P.	Md. Environmental Trust

(Additional Registrations as of September 16, 1971)

PARTICIPANTS IN THE WORKING CONFERENCE

UNIVERSITY OF MARYLAND

SEPTEMBER 16-18, 1971

NAME	AFFILIATION
Beavin, Benjamin	Beavin Company Consulting Engineers
Beers, Roland	The Johns Hopkins University
Bormel, Joseph	Comptrollers Harbor Pollution Comm.
Culbertson, Steele	National Fisheries Institute & National Fish Meal Association
Fraser, Donald M.	Republican Party of Virginia
Mrs. Gerber, George	YWCA Environmental Task Force
Harding, Diller	Virginia Oyster Packers Association
Jones, T. Ray	Citizens Council for A Clean Potomac
Nickerson, Paul	State Health Department (Md.)
Perkins, K.E.	Dept. of Natural Resources (Md.)
Sanford, Calvin	Republican Party of Virginia
Sommerville, A.J.	Commonwealth of Pennsylvania
Sougel, K.P.	Health Department (Md.)
Stern, Helen	Virginia League of Women Voters
Stevens, N.T.	Civil Engineering Department (POA)
Tallon, Philip	American Institute of Planners & Md. Interprofessional Comm. on Envir. Design
Tompkins, James	Dept. of Recreation, Washington, D.C.
Van de Velde, Louis	IBM
Ward, Kathryn	Upper Chesapeake Bay Watershed Assoc.
Zimmerman, Raymond	Izaak Walton League (Rossmoor)

BALTIMORE DISTRICT CORPS OF ENGINEERS
P O BOX 1715
BALTIMORE MARYLAND 21203

NABPL-C

29 November 1971

TO ALL PARTICIPANTS, CHESAPEAKE BAY STUDY

I would like to bring you up-to-date on the organization and management of the Chesapeake Bay Study within the Baltimore District. Mr. Alfred E. Robinson, Jr., who was formerly Assistant Chief of the Planning Division, has been designated Chief of the Chesapeake Bay Study Group. Two sections, the Study Coordination and Evaluation Section and the Technical Studies and Data Development Section, have been established within this Group. Mr. Robinson can be reached at (301) 962-4710.

Mr. Noel E. Beegle has been designated Chief of the Study Coordination and Evaluation Section. The functions of this section will include overall management of the study and model, liaison and coordination with other agencies, coordination of work with other agencies and other elements of the District, a public participation program, and formulation of plans and water resource management strategies of the Bay. Mr. Beegle can be reached at (301) 962-2558.

Dr. James H. McKay, Jr., has been designated Chief of the Technical Studies and Data Development Section. The functions of his section will include collection of data as report input for evaluation of management and product alternatives, liaison and coordination of overall data collection activities for the study and model, administration of requirements for water resource development, and preparation of designs and cost estimates for water resource oriented projects in the Bay. Dr. McKay can be reached at (301) 962-3204.

If you have any problems or need information, please do not hesitate to call on any of the aforementioned gentlemen. Also, I request that you keep this office informed of any changes in addresses or representatives of your agency participating on the study.

Sincerely yours,

William E. Trieschman, Jr.

WILLIAM E. TRIESCHMAN, Jr.
Chief, Planning Division

NABPL-C

4 October 1972

MEMO TO THE FILE

SUBJECT: Meeting With Dr. Eugene Cronin of the Natural Resources Institute

1. On 28 September 1972, the undersigned and Mr. Alfred E. Robinson, Jr. attended a meeting at the University of Maryland with Dr. Eugene Cronin of the Natural Resources Institute. The purpose of this meeting was to discuss the Public Participation and Information Program which was developed for the Chesapeake Bay Study.

2. A question concerning the establishment of a Citizen's Advisory Group for the Chesapeake Bay Study to help provide functional two-way communication between the planner and the "publics" was raised. Dr. Cronin suggested that members of the Citizen's Committee, set up during the working conference of the Citizen's Program for the Chesapeake Bay at the University of Maryland in September, 1971, be asked to establish this Citizen's Advisory Group. Dr. Cronin contended that the Citizen's Committee could select members to serve who were good representatives of such public factions as conservation groups, public service agencies, industry, and political action groups.

3. A question was raised as to whether Study funding could cover such expenses incurred by Advisory Group members as traveling costs and per diem. It was decided that the possibility of such funding would be investigated.

4. If a positive decision is reached by the Study Group regarding selection of the Citizen's Advisory Group by the Citizen's Committee, a program will be presented at the next meeting of the Committee's Executive Council outlining the composition, objectives, and outputs of the Citizen's Advisory Group. If the Executive Council reacts in a positive manner, the proposal will be presented to the Citizen's Committee itself.

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CF: Ch, Planning Division

NABPL-C

15 November 1972

MEMO TO THE FILE

SUBJECT: Meeting with the Steering Committee of the Citizen's Planning Committee for the Chesapeake Bay (CPCCB)

1. On 8 November 1972 Mr. Noel Beegle and the undersigned attended a meeting at the Wye Institute with the Steering Committee for the Citizen's Planning Committee for the Chesapeake Bay. The general purpose of the meeting was to discuss the creation of a Citizen's Advisory Group for the Chesapeake Bay Study.

2. In attendance besides the representatives from the Baltimore District were the following members of the Steering Committee:

a. Mr. Jack Kimberly, Chairman

b. Mr. Edward Aiton, Izaak Walton League (Md.)

c. Dr. Eugene Cronin, Natural Resources Institute

d. Mr. James Nelson, Wye Institute

e. Mr. William Prier, Chesapeake Bay Seafood Industry Association

f. Mr. Jeremiah Valliant, Boat Act Advisory Committee and U.S. Power Squads

g. Mr. Edward Vinnicombe, Jr., Citizen's Committee on Modernization of Maryland Courts and Justice, Inc.

Not in attendance but also a member of the Steering Committee is: M's. Beverly Holmberg, League of Women Voters (Va).

3. The Chesapeake Bay Study Group is in the process of setting up a Citizen's Advisory Group as part of its Public Participation and Information Program. It was decided that, if possible, an existing Citizen's Group should be selected since such a group would take advantage of the organization, resources, and local contacts already developed by that group. An existing group might also form the Advisory Group as a subcommittee of the parent agency and invite participants from other groups to serve on the subcommittee.

4. The Chesapeake Bay Study Group was interested in determining whether or not the CPCCB would be the appropriate committee to set up this Citizen's Advisory Group. The specific purpose of this meeting, therefore, was to find out more about this committee and, in turn, to inform them about the Chesapeake Bay Study.

NABPL-C 15 November 1972
SUBJECT: Meeting with the Steering Committee of the Citizen's Planning Committee for the Chesapeake Bay (CPCCB)

5. The CPCCB is a group made up of members of organizations concerned with implementing and assisting in the achievement of a published plan and program for managing the resources of the Chesapeake Region. The Committee has held two working conferences, one in College Park, Maryland, and the other in Fredericksburg, Virginia. A Steering Committee composed of chairmen of various subcommittees has been set up and meets periodically to develop policy and set tasks.

6. After being informed of the Chesapeake Bay Study, its purpose, objectives, and status, the Steering Committee members affirmed their interest in the Study's Citizen's Advisory Group.

7. Upon receipt of additional information from the Steering Committee outlining what they have done and who their members consist of, a decision will be reached by the Study Group regarding selection of the Citizen's Advisory Group by the CPCCB. A formal proposal in the form of a letter will then be drawn up and sent to the Steering Committee. Upon affirmation of this proposal by the Steering Committee, a presentation will then be made to the Committee as a whole for their approval.

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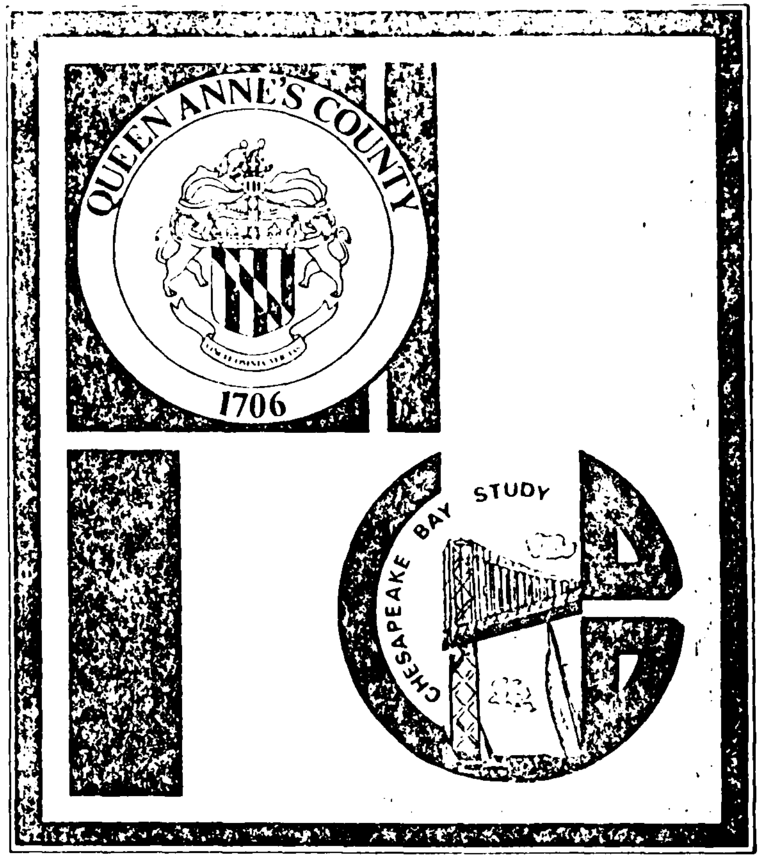
Chesapeake Bay Hydraulic Model Complex Groundbreaking Ceremony



JUNE 11, 1973

Sponsored By

THE COUNTY COMMISSIONERS OF QUEEN ANNE'S COUNTY

THE BAY MODEL

As part of the Corps of Engineers' Chesapeake Bay Study, the Hydraulic Model will be the single most valuable tool available for gaining a better understanding of the Chesapeake Bay. Water resource planners, engineers, and scientists from Federal and State agencies and educational institutions will use the Model to study both the existing conditions of the Bay and the impact of man-induced changes on this large and complex estuarine system.

Information from the Hydraulic Model tests will be a vital factor in the formulation of a "water-land management program." This management program will provide both public and private groups with guidelines on how the numerous, but limited, resources of the Bay can best be used while maintaining the beauty and dignity of the Chesapeake Bay.

PROGRAM

presiding

JULIUS GROLLMAN, PRESIDENT
THE COUNTY COMMISSIONERS
OF QUEEN ANNE'S COUNTY

LUNCHEON -- 11:00 AM

Invocation
The Reverend Roy B. Phillips

Introduction

Address
Colonel Louis W. Prentiss, Jr.
District Engineer
Baltimore District

Luncheon

Announcements

GROUNDBREAKING CEREMONY - 1:00 PM

Invocation
The Reverend Thomas Hurley

Introduction

Address
Honorable Rogers C. B. Morton
Secretary of the Interior

Honorable J. Millard Tawes
Former Governor
State of Maryland

"Groundbreaking"

BENEDICTION
The Reverend Thomas Hurley

Queen Anne's County High School Band
Richard Bentz, Director

THE COUNTY COMMISSIONERS OF QUEEN ANNE'S COUNTY

Julius Grollman, President

John M. Ashley, Jr.

Leonard E. Smith

James E. Thompson, Jr., Attorney

Lynda H. Palmatary, Clerk

Jeannette S. Coleman, Deputy Clerk

U.S. ARMY CORPS OF ENGINEERS

MG Richard H. Groves, Division Engineer, North Atlantic Division

COL Louis W. Prentiss, Jr., District Engineer, Baltimore District

CHARLES E. BROHAWN AND BROTHERS, INC.

Lee A. Brohawn, President

H. Douglas Fox, Project Engineer

WHITMAN, REQUARDT AND ASSOCIATES CONSULTING ENGINEERS

Charles F. Millard, Partner

NABPL-C

3 February 1975

MEMO TO THE FILE

SUBJECT: Annual Meeting of the Citizens Program for the Chesapeake Bay

1. On the 6th and 7th of January 1975, the undersigned attended the annual meeting of the Citizens Program for the Chesapeake Bay in Newport News, Virginia. The purpose of the meeting was to address the following areas of concern:

a. The desirability of establishing a Bay-wide basin commission

b. Progress and plans in coastal zone management in Maryland and Virginia

c. Progress made toward solutions of water quality problems affecting the seafood industry of the Bay

A copy of the program format is included as Inclosure 1.

2. Mr. Warren Fairchild's speech concerning the function and operation of Title II river basin commissions is included as Inclosure 2. Speakers after Mr. Fairchild expressed concern over the formation of one more bureaucracy and the possibility that a Chesapeake Bay commission might merely duplicate the efforts of the Coastal Zone Management Program and the Corps' Chesapeake Bay Study. Concern was also expressed about the fact that the State governments would be under-represented in relation to Federal members on a Title II commission. It was felt that it would be easier to coordinate the activities of Maryland and Virginia alone rather than the two States plus all the Federal members of the commission.

3. On the other hand, it was felt that a Title II commission would provide the necessary regional approach to the Bay's problems as well as promote coordination between the various Federal agencies. In addition, a Title II commission is flexible enough to meet the needs of the specific region, is easily formed (and disbanded if it doesn't work), and generally speaking if the States are against a proposal or plan there is very little chance that it will be seriously considered or implemented.

4. My general impression was that most of the meeting participants were in favor of a Title II type commission for Chesapeake Bay with the reservations mentioned above.

NABPL-C 3 February 1975
SUBJECT: Annual Meeting of the Citizens Program for the Chesapeake Bay

5. There were several speakers on the subject of the Coastal Zone Management Programs (CZMP) in Maryland and Virginia. These programs have just recently received funding and are in their initial stages of development. The public participation programs seem to be the most developed with slide shows being prepared by each State. It was generally agreed that offshore drilling for petroleum is the most pressing problem facing the CZMP's at this time.

6. It was the opinion of the speakers on water quality problems affecting the seafood industry that existing and soon to be effective Federal and State regulations controlling industrial, municipal, and military discharges will be highly beneficial to the seafood industry. Accidents, such as oil spills, will probably continue to be a major problem especially in view of the fact that one major oil refinery (175,000 barrels/day) has been proposed and another rumored for the Hampton Roads area. It was also mentioned that more study is needed for many chemical effluents whose toxicity levels are unknown or imprecise.

7. The proceedings of this meeting will be published at a later date.

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JAMES B. COULTER
SECRETARY

STATE OF MARYLAND
DEPARTMENT OF NATURAL RESOURCES
TAWES STATE OFFICE BUILDING
ANNAPOLIS 21401

LOUIS N. PHIPPS, JR.
DEPUTY SECRETARY

May 14, 1975

Mr. Alfred Robinson
Department of the Army
Baltimore District
Corps of Engineers
P.O. Box 1715
Baltimore, Maryland 21203

Dear Ted:

Secretary Coulter may be unable to attend the meeting of the Chesapeake Bay Study Advisory Group on May 28th and has asked me to represent him at this meeting in case he is unable to attend.

I have prepared for the Secretary a priority listing of the studies requested by the various units of this Department. A copy of this list as approved by the Secretary is attached. You will note that there are four major categories, each of which include similar study requests from several different units of the Department.

I hope this will satisfy the request expressed in Bill Trieschman's letter to Secretary Coulter dated 11 February 1975.

I will see you on the 28th.

Sincerely,

Paul

Paul W. McKee
Assistant Secretary

PWM:fcg
Enclosure

DEPARTMENT OF NATURAL RESOURCES REQUESTS FOR STUDIES TO BE PERFORMED ON THE CHESAPEAKE BAY HYDRAULIC MODEL--PRIORITY LISTING OF THE FOUR MAJOR CATEGORIES

I. Dispersion of various components, sediment, spoil, waste discharges, chemical, radiological, thermal.

Water Resources Administration--Studies of sediment dispersal in the Bay and indirectly study of the dispersal of pollutants that are absorbed to sediments. Determination of such dispersal patterns are necessary because some pollutants such as oil both tends to float on the surface and to become absorbed to suspended sediments and sink to the bottom. Thus, their movement depends upon both surface and bottom conditions.

Fisheries Administration--Dispersion of spoil in various parts of the Bay and major tributaries. Study of movement of various particle size to determine direction and severity of turbidity and siltation from the source of a substrate disturbance such as dredging and spoil disposal using various types of bottom material under various materials.

Fisheries Administration--Determine extent of nutrient transport, accumulation and dilution as a means of explaining plankton blooms and the possible disbursing of obnoxious blooms.

Maryland Environmental Service--Determination of dispersion coefficients and their relationship to freshwater inflow for the major estuarine tributaries of the Bay and in the Bay proper. This information would be useful in developing bio-chemical mathematical models for pollution control studies.

Water Resources Administration--The studies of current velocities and prevalent winds occuring on the Bay can give the Water Resources Administration a knowledge of such probable spill trajectories within Chesapeake Bay which would be useful in evaluating the potential impact of an oil spill within the Bay, determining the most desirable location for a pipeline corridor if one is desired, and aiding clean-up operations in the event of a spill.

The spill trajectories could be to reasonably well predict the dispersion and movement of major wastewater discharges (say approximately 50 mgd). This information, in turn, could then be used to fine-tune mathematical models, for example, the prediction of the movement and dispersion of spoil materials placed in Pooles Island Deep.

Power Plant Siting Program--The Power Plant Siting Program has begun negotiations with the Corps of Engineers related to the early use of the Bay Model to analyze several potential power plant sites in the Upper Bay. These sites will include Bainbridge, Chesapeake City, and Stillpond Neck (if the latter is purchased by PPSP). The tests will investigate the dispersion of waterborne chemical, radiological, and thermal effluents. Unfortunately, discussions with the Corps to date indicate the Bay Model is not capable of

I. (continued)

analyzing more than two sources simultaneously (for cumulative impact), and methodology for simulating the entrainment of planktonic organisms has not been developed. If these two deficiencies were remedied, the Bay Model's versatility would be greatly increased.

II. Determination of circulation patterns and flushing rates of Bay's sub-estuaries.

Water Resources Administration--Determination of existing water circulation patterns and flushing rates of the Bay's sub-estuary. Preliminary information should be related to ambient water quality and known discharges to calculate the assimilative capacity of each sub-estuary. This data could then be related to proposed works and discharges associated with such works to determine necessary restrictions on or relocation of these works. To do this, dye studies should be performed in areas subject to specific types of wetlands development. These areas should correspond directly to both existing and potential sites for marinas and urban development and locations that correspond directly with historic pressures to dredge.

Major centers of urban development include Anne Arundel, Baltimore, and Queen Anne's Counties. Specific sub-estuaries within these counties subject to extensive development include:

AA - Magothy, Severn, and South Rivers
BA - Patapsco, Back, and Middle Rivers
QA - Kent Narrows, Wye, and Chester Rivers

Fisheries Administration--Delineation of movements and currents in order to: (a) determine movement and dispersion of oyster larvae, fish eggs and larvae, crab larvae, and clam larvae; (b) pinpoint origin of floating masses of dead fish; and; (c) plot dispersion and movement of aquatic plant seeds and fragments as a means of predicting infestation routes of noxious plants and possible revegetation of certain areas.

Fisheries Administration--Measurement of water volume and flushing rates in tributaries and embayments to provide basic information prerequisite to decisions on locating discharge points for sewage, heated water, industrial effluents, et cetera, in relation to probable effects on the water and biota of an area.

Water Resources Administration--One of the major areas that the Hydraulic Model can provide some reasonable answer to is that of the probable effect on water movement in Baltimore Harbor if changes in the bottom contour were considered such as that resulting from the utilization of discontinued spoil disposal areas for spoil containment. This is an important area of application for the Hydraulic Model since the driving force in Baltimore Harbor is due to the strong tidal currents originating from the Chesapeake Bay.

Maryland Geological Survey--One of our needs is current velocity data for the Bay tributaries. A study of this type is within the capabilities of the model.

II. (Continued)

Fisheries Administration--Determine effects of jetties, piers, and sand bars on water movement and flushing rate of small water bodies in order to describe modifications to aquatic communities.

III. Study the causes and determine the effects of flow regime modifications.

Maryland Environmental Service--Investigate effects of flow regime modifications caused by changing land use on salinity profiles of the Bay and its major estuarine tributaries, i.e., what effect would a land use change that resulted in x% increase in basin wide runoff have on the salinity profile of a given subsystem or the Bay itself. Solve for a range of percentage flow increases to determine sensitivity of salinity profile to freshwater flow. This kind of information would be very useful in determining what percentage of a watershed can be paved over before we start to worry about causing major changes in the estuarine eco-system.

Maryland Environmental Service--Investigate the impact of major inter-basin transfers of freshwater on the salinity profiles of the Bay and its major estuarine tributaries, i.e., diversion of water from the Susquehanna and Potomac to other sub-basins for water supply purposes.

Fisheries Administration--Study effects of C & D Canal enlargement on isohalines in the upper half of the Bay.

Water Resources Administration--The effects of the reduction of flow of the Susquehanna River due to increased withdrawals.

Water Resources Administration--Effects of upstream channel modifications on the salinity, hydraulics of the Bay's estuaries.

Water Resources Administration--The effects of salinity regimes due to increased runoff caused by impervious surface from increased urbanization.

B-116

IV. Study the formation of thermoclines and the influences that change them.

Fisheries Administration--Determine rapidity of water temperature change in various areas to explore causes of mass mortalities in aquatic animals, particularly fish. Examine related effects of other hydrographic factors such as water depth, volume, inflow, wind direction and velocity, turbidity, and color on water temperature fluctuations.

Fisheries Administration--Determine influences of various hydrological and metrological conditions on the formation of thermoclines in deep tidal waters and the volume, persistence, and movement of de-oxygenated waters.

Fisheries Administration--Measure extremes of temperature, salinity, oxygen, etc., in deep holes and channels to evaluate importance of these areas for fish survival, particularly during winter freezes.

V. Prediction of storm tide inundation.

Water Resources Administration--Prediction of storm tide inundation areas. We know that flood plain encroachment in riverine areas can have an adverse effect on the hydraulics of the system. There may be similar problems associated with flood tides in coastal areas. If extensive land filling on land surrounding the Bay, to meet the requirements of F.I.A. (Federal Insurance Administration) is done, there may be adverse hydraulic effects. If the sufficient land areas have been included in the Model, the study may be able to determine this effect.

VI. Verify the Chesapeake Bay Mathematical Model.

Water Resources Administration--Finally, the Hydraulic Model could be used to add another level of confidence to our Chesapeake Bay Mathematical Model. (If one model checks the other model, you tend to feel that much more certain of your modeling capability and predictions.)

FEDERAL POWER COMMISSION
REGIONAL OFFICE
26 Federal Plaza
New York, New York 10007

May 23, 1975

Colonel Robert S. McGarry
District Engineer
Corps of Engineers
Department of the Army
Baltimore District
P.O. Box 1715
Baltimore, Maryland 21203

Dear Colonel McGarry:

Reference is made to your letter of April 21, 1975, inviting our comments on the first year testing program of the Chesapeake Bay Hydraulic Model now under construction. Since our primary concern is in the field of electric power our remarks are directed to the effect on electric operations that controls on the Basin's water resources may have, as revealed by model tests. The Federal Power Commission is not an action agency and has no jurisdiction over the construction and operation of electric facilities, other than non-Federal hydroelectric power projects and associated primary transmission.

Utility system components that would be most seriously affected by restraints on use of Basin waters are steam-electric generating stations, both nuclear and fossil fired. As in the proposed "Upper Bay Power Plant-Thermal Effects Study," the case of capacity employing once-through cooling (existing, under construction, and scheduled), model tests will indicate whether or not thermal discharge characteristics are acceptable. Please note, however, that in studies of future power supplies engaged in by this office, steam-electric plants sited on a body of water such as Chesapeake Bay would be assumed to use cooling towers in keeping with the trend in that direction. This would, of course, result in substantial increases in consumptive water use indicating that salinity tests would be useful in helping to determine if the projected evaporative losses could be tolerated.

Finally, the test would be useful in establishing discharge levels of chemicals used in water treatment, and possibly in evaluating radioactivity associated with nuclear plants.

Our interest in the above examples is not direct, as noted previously, but only insofar as they may influence the adequacy and reliability of power supply in the Chesapeake Bay Basin. Conceivably, further model tests could indicate the need for changes in location, size, and type of prime mover in order to comply with standards of water use, and in this manner be a valuable tool in system planning.

Sincerely,

A. M. Monaco
Regional Engineer

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE - 4321 Hartwick Road
College Park, Maryland 20740

May 27, 1975

Col. Robert S. McGarry, District Engineer
Department of the Army
Baltimore District, Corps of Engineers
P. O. Box 1715
Baltimore, Maryland 21203

Dear Col. McGarry:

In response to your letter dated April 21, 1975, the Soil Conservation Service submits the following comments on the preliminary first draft of your Chesapeake Bay Study report covering the proposed first year hydraulic studies program:

1. The SCS is involved with many projects in Delaware and on the Eastern Shore of Maryland where local sponsors request the reconstruction of major channel outlets in order to provide relief for floodwaters and agricultural drainage systems. Can or will the low and high freshwater inflow studies be run with inflow hydrographs that reflect natural conditions and proposed modified channel systems? If so, this will allow a better analysis of the probable effects of these modifications on the Chesapeake Bay System.

2. It would be better to call the Environmental Impact Severity Index discussed on pages 13 and 14 and other places in the report an Ecological Impact Severity Index, since you are using as an index value only species and ecosystems rather than the total environment.

3. Additional comments developed by the SCS, Delmarva River Basins Survey Staff located at Salisbury, Maryland, are attached.

Thank you for the opportunity to comment on this report. The SCS is very interested in the results of the hydraulic studies program and look forward to your test reports on these studies. If we can be of any assistance in this testing program, please advise.

Sincerely,

Graham T. Munkittrick

Graham T. Munkittrick
State Conservationist

Attachment

Comments on Chesapeake Bay
Hydraulic Model Study

The following are comments made by the Delmarva River Basins Survey Staff on the draft of the Chesapeake Bay Study - Hydraulic Model Program.

The area on the Delmarva Peninsula draining into the Bay is very small in land area and population compared to other areas draining into the bay. The Problem Magnitude Index as well as the Social and Economic Impact Severity Indexes seem to be based primarily on population. Therefore, the Peninsula will be discriminated against in getting any high priority for studies. Also, because of the small land area and small percentage of runoff to the Bay almost any of the impact indexes will be very low thus giving a low priority.

There are a number of studies needed that would effect the Delmarva area. The following are a few of the studies that would give some needed answers to decision makers:

1) Effects of enlarged channels to facilitate drainage of agricultural land
2) Effects of runoff from agricultural land (sediment, nutrients and/or pesticides)
3) Study of sediment movements in the Bay so that toxic sediment moving onto oyster beds can be determined in advance thereby keeping the impacts on the shellfish and related industry to a minimum
4) Study of effects on the Bay of water desalination for municipal water supply for Virginia Eastern Shore
5) Effects of dredging on the Wicomico River.

Concerning the Low and High Freshwater Inflow Studies, would the effects of freshwater flow from the Delmarva Peninsula be evaluated? Also, information gained for the freshwater inflow study would give valuable information, but because of economic and political reasons very little could be done with the information in the near future.

More consideration should be given to the Chesapeake Bay Tidal Flooding Study. This is a vital problem confronting the counties and individuals along the coastal area because of the Federal Flood Insurance Programs and its regulations and concerns with the height of the 100-year frequency events. Knowledge is needed immediately on heights of the 100-year frequency events for tidal flooding. This type of information would be beneficial economically and environmentally not only to those living in the coastal areas, but all taxpayers because of the high cost of the flood insurance program and other Federal grant programs to offset extensive property damage caused by continued development in the flood prone areas.

COMMONWEALTH OF PENNSYLVANIA

DEPARTMENT OF ENVIRONMENTAL RESOURCES
P. O. BOX 1467
HARRISBURG, PENNSYLVANIA 17120

In reply refer to
RM-R
F 70:4

May 27, 1975

Col. Robert S. McGarry
District Engineer
Baltimore District - Corps of Engineers
Custom House - Second and Chestnut Streets
Philadelphia, Pennsylvania 19106

Dear Colonel McGarry:

We have reviewed the draft report on the Chesapeake Bay Study which includes the first year hydraulic studies program. We feel that the priority ranking of individual studies has been done in a fair manner and is consistent with the nature of the individual problems. We are pleased that the low fresh water inflow study was designated as having the highest priority.

This particular study is of foremost importance to our State because it will provide answers to the question of how important the fresh water inflow is to the Chesapeake Bay.

It is stated in the text that as part of this study, hydrographs for the following conditions will be examined:

1 - Average annual flow year
2 - Average low flow year
3 - Intermediate low flow year
4 - Extreme low flow year

While these four conditions may cover the full range needed for analyses, because of a lack of definition of these terms we cannot be sure that these will be satisfactory. As you are probably aware, the present guidelines (see attachment) being used in the Susquehanna River Basin Commission's Comprehensive Plan state that, "low flow to the Chesapeake Bay shall not be reduced. Low flow to the Chesapeake Bay is defined as the one-in-twenty year low flow in the months of August, September, and October (the flows of 3,500 cfs, 3,050 cfs, and 2,820 cfs into Conowingo Reservoir during August, September, and October respectively are selected surrogates for low flow into the Bay at the mouth of the Susquehanna River during these months.")

It is understood by the four signatory parties of the Commission that this guideline is being utilized temporarily until more information is developed which would indicate better guidelines. Although Pennsylvania has agreed to this temporary guideline, we feel that it has not been proven

that it is needed and we look to the hydraulic model to supply these answers. Also, we do not feel that the inflow to Conowingo pool is equivalent to the inflow into the Chesapeake Bay. We have pointed out that the storage behind the Conowingo Dam, the diversions from the pool (existing and planned), and the variable releases from the dam should all be taken into account to determine the flow downstream of this dam.

Under our State Water Plan program, we have developed a low flow criteria which we are using for planning purposes. We are also considering the advisability of using the proposed criteria for making regulatory decisions on water allocations. The basic principle of our low flow criteria is that the existing low flow conditions of Pennsylvania streams should not be reduced in the future because of increased consumptive uses. To achieve this goal, the criteria specifies that when the flow reaches the 10-year 7-day level, that all increased incremental consumptive uses must be replaced until the low flow conditions increase above that level. This means that the existing flow conditions from Pennsylvania can be considered as representative of flow conditions that will persist into the future. Therefore, we feel that the hydraulic model should examine the full spectrum of low flow that has existed up to this time. We are opposed to any flow augmentation scheme that would require maintaining a minimum flow. We do, however, strongly support flow augmentation for the purpose of making up consumptive losses during low flow conditions.

We appreciate the opportunity for input into your model study, and we hope that we can be of future assistance in providing guidance.

Sincerely yours,

C. H. McConnell

C. H. McConnell, Deputy Secretary
Resources Management

encl.

United States Department of the Interior
OFFICE OF WATER RESEARCH AND TECHNOLOGY
WASHINGTON, D.C. 20240

IN REPLY REFER TO:

MAY 27 1975

Colonel Robert S. McGarry
District Engineer
Baltimore District, Corps of Engineers
P. O. Box 1715
Baltimore, Maryland 21203

Dear Colonel McGarry:

This is in response to your request of April 21, 1975 that written comments concerning the first draft report on the Chesapeake Bay Study be brought to the May 28 meeting of the Advisory Group and Steering Committee.

Because of death or retirement, representation of the Interior Department -- through the Office of Water Research and Technology during the past ten year -- has been interrupted, with three different individuals involved. During my tenure of slightly over a year, the Steering Committee apparently has not met. My comments should be evaluated, therefore, with the knowledge that my working relationship to the project has been very limited and my dealings with the various agencies concerned have been on mostly on the other matters.

Introduction

No comment except to note that it is difficult to manipulate physical parameters in a model that duplicate conditions in the real world estuary; nonetheless the model should be helpful in predicting biological stress.

Chapter 2

With respect to the Environmental Impact Severity Index, page 14, it would seem to me that a separate rating--probably 5-A--should be used in lieu of index values 3 and 4 in the criteria which mention permanent destruction of a "few important" and "several important" species but I don't think they should apply to species--when they are gone, they are gone forever.

With respect to the Social Impact Severity Index, is it implied that curtailment of recreational opportunities is a threat to public health?

In Table 1, Item A-1, the value of 3 under severity of environmental impact indices would indicate "permanent destruction of a few important species." Is this really what is meant, or is it intended to indicate mortality of a few individuals of a species?

Presumably, page 22, paragraph 2, line 3 to 5 and Table 2, time estimates for data analysis and report writing for the various studies proposed must have been made to develop cost estimates for these activities; why not include them?

Chapter 3

The proposed Low and High Freshwater Inflow Studies of Bay-wide scope would appear to be of considerable interest to various Interior Department agencies and, as pointed out, should be helpful for planning purposes.

Chapter 4

No additional comments. Studies seem well conceived.

Appendix A

The Department of the Interior, would I believe have considerable interest in the proposed Upper Bay Power Plant - Thermal Effects Study.

If possible, addition to the Baltimore Harbor Channel Enlargement Study of investigations on sedimentation and turbidity resulting from the channelization, would be of interest. I doubt if all the impacts would be treated under the North Bay Dredge Material Disposal Study. The same would seem to apply for the Norfolk Harbor Channel Enlargement Study and the South Bay Dredge Material Disposal Study as well as the York Harbor Channel Enlargement Study i.e, what happens to the silt stirred up in dredging which isn't conveyed to a disposal site?

Daniel L. Leedy
Daniel L. Leedy

United States Department of the Interior

OFFICE OF THE SECRETARY
NORTHEAST REGION
JOHN F. KENNEDY FEDERAL BUILDING
ROOM 2003 J & K
BOSTON, MASSACHUSETTS 02203

May 27, 1975

District Engineer
Baltimore District
Corps of Engineers
Post Office Box 1715
Baltimore, Maryland 21203

Dear Sir:

The U.S. Department of the Interior considers it a privilege to be represented on the Chesapeake Bay Study Advisory Group and Steering Committee. Chesapeake Bay is a most productive coastal estuary. However, the mushrooming population of the northeast United States (Washington, Baltimore, Philadelphia, Norfolk) continues to exert its influence on this valuable coastal ecosystem. Chesapeake Bay is probably one of the most studied estuaries in the country; yet, each day we are faced with resource management decisions, and we realize how little we really know about this dynamic estuary and its resources. We must continue to make the decisions that confront us, hoping we are right. We look at the Chesapeake Bay Model as one of the landmark tools to aid decision making in this area in the future.

Our Secretary Morton, who was in attendance at the ground-breaking ceremony of this model, was enthusiastic about the model and its contribution to the Chesapeake Bay Resources. Now, some years later, we are close to seeing the model complete and are drafting the first year of tests to be completed with this valuable tool. The Department of the Interior is confident that the information generated by the first year of testing will be invaluable and would request to receive copies of all reports generated as a result of the testing program.

In your letter of April 21, you requested our specific comments on the possible studies, testing priorities, and tentative recommendations for the first year of modeling.

We noted in the description of the m del capabilities that sediment distribution studies are within the scope of the model analysis. Yet, further into the draft report it is stated that five years of hydrographic survey data and the addition of specific equipment in the model is necessary to implement this capability. We endorse legislation to the Congress requesting supplement appropriations that wquld include this additional parameter in the modeling program.

We can appreciate your efforts to produce a numerical rating system in order to assist in prioritizing the proposed test. We generally agree with your parameters and their numerical rating; however, some of the ratings in Table 1 on Page we feel may be in error. For example:

1. Potomac River Estuary Water Supply Study -- It is given a rating of 2 in magnitude. In severity it is rated "2" meaning significant temporary disruption of a few *species or areas no irreversible loss."* The Potomac Water Supply Study will definitely impact a large population center. Washington, D. C., and suburbs will further the impact of additional major withdrawals from the Potomac Basin and will have an impact on the entire subsystem. The water withdrawal at present exceeds recorded low flow of the basins. With an additional water supply demand placed on the system, the following could be impacted:

   1. A negative flow from the Potomac Basin if water is exported from the basin;

   2. With saltwater intrusion up the basin, increased oyster bars and MSX mortality at the mouth of the river;

   3. A buildup of chlorine and chloramens in the Potomac Basin, impacting shellfish reproduction;

   4. Creating demands for upstream reservoirs to augment stream flow and water supply;

   5. Impingement and entrainment of organisms on intake structures. As I am sure you are aware, most water resource proposals also have impacts which we cannot foresee and, thus, this is a cursory analysis of Table 1. The Department would suggest that the priority of projects to be run on the model be analyzed on those studies that we need to answer management decisions within the capability of the model itself, including time and money restraints.

We have no objection to the selection of the four major tests you expect to run in the first year of operation, as much of the data generated will have immediate application. We would hope that those studies which involve model geometry alteration will soon follow the first year of study, as many management decisions are also pending on those data. As we assume that the model testing program is designed to, as closely as possible, simulate real conditions, we have comments on the Individual Test Descriptions which, if implemented, we feel will result in more biologically significant information.

Test 1 - Chesapeake Bay Low Freshwater Inflow Study

During the low flow testing program, Phase 1 and Phase 2, the daily average or weekly average flow is not the kind of data needed from a biological standpoint. As biological systems survive or expire on extremes, a simulation of actual flows from the Conawengo Dam showing fluctuations caused by actual power plant operation, including zero releases at night and on weekends, would be more valuable.

During the establishment of base conditions with an average inflow year, it would be extremely valuable to simulate pre-1964 peaking flow fluctuations as they actually occurred at Conawengo (not daily averages). In the second half of base conditions with an average inflow year, it would be valuable to simulate post-1964 peaking flow fluctuations as they actually occurred at Conawengo (not daily averages). This should also include the pump storage withdrawal from Conawengo. Of specific value would be data generated in the months of April through September.

During the testing of average low flow year, intermediate low flow year, and the extreme low flow year, the C&D Canal impact at its present -35 feet, plus two foot allowable overdredge depth, should be closely monitored. Also during these three low flow conditions, the proposed water withdrawal by the City of Baltimore should be incorporated to evaluate the additional system stress. If this is better simulated in a separate test, the three low flow conditions should be utilized.

Generation of the data from this test should be available as soon as possible, as Conawengo and the other upstream FPC hydro projects are up for relicensing in the next year or two and will be invaluable in the decision-making process.

Test 2 - Chesapeake Bay High Freshwater Inflow Study

It is noted in this three-phase testing program that the tidal effects will be average, as high freshwater inflow could and frequently is associated with a tropical depression. The test would be more indicative of prototype if extreme high tides and extreme low tides were also injected into the system. *Depending on tropical storm locations in relation to the*

Test 7 - Baltimore Harbor Channel Enlargement Study

We realize this test will not be run during the first year of testing as it will involve alteration of the model geometry. This test when run should closely follow and or be incorporated with Test 9. The model geometry should also be changed to -52 feet rather than -50 feet which is the Congressionally authorized channel depth. The minus 52 feet will represent the channel and the allowable overdepth dredging. This test should be run by itself and in conjunction with Test 8 which includes a -55 foot channel into Norfolk Harbor. Both channels in combination could result in significant bay salinity changes. While both channels are being simulated on the model Test 11 the York Harbor Channel should also be run to determine the salinity changes which may occurr in that system. Also the very large channel necessary for access by "Brown & Root" to their Accomack County location should be simulated.

Test 8 - North Bay Dredge Material Disposal Study

This test will greatly assist in decisions to create a diked disposal area for deposition of dredge spoil from Baltimore Harbor. The test will involve model geometry revision thus it will not be run during the first year of testing. Any channel and rehandling basins needed to accomodate spoil disposal should also be incorporated in design of tests. As a commitment of approximately 1000 to 2000 acres of estuarine area is involved in this proposal, the model testing should not limit the Baltimore District study away from upland and within harbor disposal sites, also. If the ultimate location of the spoil area is found to be in the Bay the model should simulate the most adverse physical conditions that the disposal area will be exposed to (high freshwater inflow and high tides).

Test 9 - Norfolk Harbor Channel Enlargement Study

Based on past reports we have recommended to the Corps that this project not proceed until its impact could be simulated on the hydraulic model. We realize that model geometry will have to be changed to complete this test and thus it will not be run in the first year of testing. This channel should be run in tests by itself however, it should also be run in combination with other proposed channels as discussed in Test 7.

Test 10 - South Bay Dredge Material Disposal Study

This test will greatly assist in decisions to create diked disposal area for deposition of dredge spoil from Norfolk Harbor or York River Harbor. The test will involve model geometry revision thus it will not be run during the first year of testing. Any channels and/or

rehandling basins needed to accomodate spoil disposal should also be incorporated in design tests. The model tests should not limit the Norfolk District study away from upland disposal sites. If the ultimate location of the spoil area is found to be in the Bay the model should simulate the most adverse physical conditions that the disposal area will be exposed to (high freshwater inflow and high tides).

Test 11 - York Harbor Channel Enlargement Study

This test will involve alteration of the model geometry and thus will not take place in the first year of model testing. The model will be run with average low steady state freshwater inflows. As pointed out earlier in our comments the environmental resources survive on extremes. The model should be run with high tides and low freshwater inflows to monitor the most extreme conditions the ecosystem will be subjected to. Also as mentioned in Test 7 the model should be run with the Baltimore Harbor Channel, Norfolk Harbor Channel and the York Channel in place, careful monitoring of salinity changes as a result of hydrologic efficiency should be carefully analyzed. Daily fluctuations are more important than averages and should be obtained if possible.

Test 12 - Potomac River Waste Water Dispersion Study

This test is combined with the Potomac Water Supply test and will be discussed later in our comments.

Test 13 - Patuxent River Waste Water Dispersion Study

This test will not require model changes but will not be run during the first year of testing. When this test is run additional biological information can be obtained if an additional monitoring effort is incorporated. One of the future problems with shellfish production in Chesapeake Bay is the build up of chlorine and chloramine in the estuarine systems. The biological degradation of chlorine in coastal systems is a known factor. If the dye is injected into the model test and carefully monitored in volume the accumulation and possible area of impact of chlorine can be statistically calculated. The Patuxent River Power Plant discharge should, if possible, also be injected into this test as the heated effluent would significantly influence the impact of wastewater discharges within the estuarine system.

Test 14 - James And Elizabeth Rivers Waste Water Dispersion Study

We realize this study will not be run in the first year of testing. When this test is run the volume of dye at each discharge should be carefully monitored as additional biological impacts can be extrapolated from this test as indicated in Test 13. The lower James River is a

very valuable seed oyster production area and this test will provide very valuable information necessary for management decisions.

Test 15 - Patapsco River Waste Water Dispersion Study

We realize this study will not be run in the first year of testing. When the test is run the volume of dye at each discharge should be carefully monitored as additional biological impacts can be extrapolated from the test as indicated in Test 13. Also the thermal plume of the Wagner fossil fuel and Banden Shores nuclear power plants should be incorporated into the test as the heated discharge will significantly influence the impact of the wastewater discharge.

Test 16 - Back River Waste Water Dispersion Study

This test will not be run in the first year of model verification. When the test is run the dye volume should be carefully monitored as indicated in Test 13.

Test 17 - Combined Potomac River Estuary Water Supply And Waste Water Dispersion Studies

This test will be run in the first year of model verification and is a combination of tests 4 and 12. As pointed out in the NEWS study the Washington D.C. area is faced with critical water supply problems. We agree with its selection in the first year of study. Much of the information will have immediate application as many permits for water withdrawal are pending in the Potomac Basin. We feel that the test results will be distorted as presently proposed. When low or zero flows occurr in the Potomac basin simultaneous low flows occurr in the other major tributaries in the Chesapeake Bay area. To leave the other basins at average flow while reducing the Potomac would not truly reflect possible salt water intrusion. The dye volume discharged to simulate waste water discharges should be carefully monitored as indicated in Test 13. The proposed Douglas Point Nuclear Power Plant and other fossil fuel powerplants on the Potomac River should be implemented in this test as they will significantly effect wastewater impacts on the estuary. The various water withdrawals should also be simulated with the projected releases from the Sixes Bridge Reservoir. This would aid greatly in projecting the reservoir management potential and its impact on the Potomac River System. Monitoring data in this test should show daily extremes in salinity, flow etc if possible not daily averages or weekly averages.

We are in hopes that the above comments assist you in the model study formulation. We are confident the information generated will have immediate application in daily management decisions. We appreciate the opportunity to comment on the proposal.

Sincerely yours,

Roger Sumner Babb

Roger Sumner Babb

JAMES B. COULTER
SECRETARY

STATE OF MARYLAND
DEPARTMENT OF NATURAL RESOURCES
TAWES STATE OFFICE BUILDING
ANNAPOLIS 21401

LOUIS N. PHIPPS, JR.
DEPUTY SECRETARY

May 28, 1975

CHESAPEAKE BAY HYDRAULIC MODEL
FIRST YEAR STUDIES

The staff of the Baltimore District Corps of Engineers is to be congratulated on doing a fine job of defining project priorities for the Chesapeake Bay Hydraulic Model first year's study program.

The rationale behind the selection of study priorities and formulation of the proposed testing program is clearly explained and appears to be logical.

The high priority studies selected for incorporation into the proposed first year program should produce a high yield of management oriented information within the given temporal and financial limits.

However, the Department of Natural Resources has the following comments and recommendations:

One of the areas of hydraulic study of interest to the Department of Natural Resources is that of shoaling rates and sediment distribution. Pages 8 and 9 of the Chesapeake Bay Study draft refers to these studies as not desirable during the first year of operation due to budgetary and data limitations. Table 1 of pages 19, 20, and 21 does not list shoaling and sediment distribution studies. There is a stated interest in this area of study by State agencies as indicated on the attached priority listing of Department of Natural Resources study requests which is provided in response to the Corps' letter to Secretary Coulter of February 11, 1975. It is hoped that the Corps will find this of sufficient interest to warrant scheduling such studies.

Other than the above, the Department of Natural Resources has the following suggestions:

1. Page 19, Table 1, Problem Impact Indices - Item C.1 - Proposed Upper Bay Power Plant Thermal Effects Study - Since proposed power plants in upper bay would impact on spawning areas which are calculated to provide - 30% of Chesapeake Bay striped bass, "magnitude of environmental impact indices(3)" should be given a score of 4. Therefore "Indices Total(8) should be 21.
2. Page 20, Table 1, Problem Impact Indices - Item C.3.- Cumulative Upper Bay Thermal Effects Study - it is our opinion that cumulative thermal effects due to power plants in upper bay will be negligible. Changes in salinity due to cumulative consumptive loss may be of greater significance. Therefore we would appreciate this study to read "Cumulative Upper Bay Salinity

Effects." The Environmental Impact Indices (2) + (3) should be changed to scores of 4 and 5 respectively. Therefore, "Indices Total (8) should be 23.

The Power Plant Siting Program has $80,000 in their Fiscal Year '76 budget for Item C.1. It is planned to include funds in FY '77 budget for Item C.3 (as modified) after receiving Corps estimate of costs.

Other than these comments relating to sediment distribution studies and the above modifications, the Department of Natural Resources supports the First Year Hydraulic Studies Program and Methodology for determining the study priorities.

Paul W. McKee
Assistant Secretary

Comments on Proposed Study Program for the

Chesapeake Bay Hydraulic Model

May 28, 1975

My comments will be brief.

As I read the first part of the draft study proposal, I thought of suggesting that the Potomac River estuary water supply and wastewater studies be combined. However, the Chesapeake Bay Study staff anticipated my thoughts by recommending just that later in the proposal. Naturally, the District of Columbia approves of the fact that the combined Potomac River estuary water supply and wastewater study is being considered for the first year of model operation.

The District of Columbia is keenly interested in the information the model could provide because:

(1) an emergency water supply pumping station is to be constructed at the upper end of the estuary;

(2) Congress has directed the Corps of Engineers to construct and operate a prototype facility to be used to determine the treatability of estuary water;

(3) the concept of using the estuary as a permanent supplementary source of public water supply appears to be receiving increasing emphasis in some quarters; and

(4) the EPA recently notified the District of Columbia that the construction of nitrogen removal facilities at the District's Water Pollution Control Plant would be deferred. During the period of deferral, EPA plans to conduct water quality studies to determine the value of nitrogen removal in water quality improvement.

I have two suggestions. One is that, if it is necessary to strenghten the justification for including the Potomac River estuary study during the first year, this might be achieved by performing an impact and priority analysis on the combined study. My second suggestion is to recommend consideration of a higher (greater than 200 mgd) pumping rate. This suggestion stems from preliminary estimates recently developed by the NEWS Study staff, which indicate a one-day deficit in the year 2000 as high as 356 mgd and a seven-day deficit of as much as 240 mgd.

Arnold Speiser, Chief
Planning Division
Water Resources Management Administration

PUBLIC INTEREST [illegible]

We might take cognizance of two other factors which are present and can be evaluated; these are public interest and timliness. As with the original draft proposal, these are not final determinations but merely aids in establishing priorities and order of accomplishment.

PUBLIC INTEREST

Index Value	
1.	Relatively few people involved. No current interest in news media.
2.	Significant public interest. Some news media releases.
3.	Vocal and widely distributed public interest. Recurring news media items.
4.	Heated public controversy. News media treating as a public issue to be aired.
5.	Bitter and continuing public controversy with sharply drawn factions and/or widespread confusion and distress. News media giving frequent in depth coverage and possibly taking sides.

TIMLINESS

Index Value	
1.	At least 5 years before issue or action is to be decided; answers now would have to be restated then.
2.	At least 4 years before issue or action to be decided.
3.	At least 3 years before issue or action to be decided.
4.	At least 2 years before issue or action to be decided.
5.	Issue or action to be decided within the next 2 years, that is within the time of first year testing results.

These matters could each be assigned a separate number, thereby raising the highest possible score from 30 to 40. They might also be combined to lessen their weighting; this could give a maximum possible score of 35.

Technical Problems Areas	Interest	Timliness	Combined average	Previous total	New total
A. Bay Wide General Tests					
1. Low Freshwater Inflow Study	1	1	1	21	22
2: High Freshwater Inflow Study	1	1	1	20	21
3. Tidal Flooding Study	2	1	1.5	21	22.5
B. Municipal Water Supply					
1. Potomac River Estuang Water Supply	2	1	1.5	18	19.5
2. Baltimore-Susquehanna River Water Supply Division	2	1	1.5	14	15.5
C. Power Plant Thermal Discharge Studies					
1. Proposed Upper Bay Power Plant Thermal Effects	2	2	2	18	20
2. Cumulative Lower Bay Power Plant Thermal Effects	2	2	2	18	20
3. Cumulative Upper Bay Thermal Effects Study	2	3	2.5	20	22.5
D. Navigation Studies					
1. Baltimore Harbor Channel Enlargement Study	2	3	2.5	21	23.5
2. North Bay Dredged Material	4	5	4.5	21	25.5
3. Norfolk Harbor Channel Enlargement	2	2	2	18	20
4. South Bay Dredged Material Disposal	2	2	2	18	20
5. York River Channel Enlargement	2	1	1.5	12	13.5

Technical Problem Areas	Interest	Timliness	Combined Average	Previous Total	New Total
E. Waste Water					
1. Potomac River Estuary Waste Water Dispersion	2	1	1.5	17	18.5
2. Patuxent River Estuary Waste Water Dispersion	1	1	1	12	13
3. James and Elizabeth Rivers Estuaries Waste Water Disposal	1	1	1	17	18
4. Patapsco River Waste Water Dispersion	1	1	1	17	18
5. Back River Waste Water Dispersion	1	1	1	13	14

PRIORITY RANGE	INDICE TOTAL SCORE	TECHNICAL PROBLEM	TIME WEEKS	COST DOLLARS
	25.5	D2 North Bay Dredged Material Disposal	16	230,000
	23.5	D1 Baltimore Harbor Channel Enlargement	16	230,000
20 to 22.5	22.5	A3 Tidal Flooding	14	510,000
High	22.5	C3 Cumulative Upper Bay Thermal Effects	7	105,000
	22	A1 Low Freshwater Inflow	23	410,000
	21	A2 High Freshwater Inflow	9	170,000
	20	C1 Proposed Upper Bay Power Plant Thermal Effects	5	80,000
	20	C2 Cumulative Lower Bay Power Plant Thermal Effects	9	140,000
	20	D3 Norfolk Harbor Channel Enlargement	10	155,000
	20	D4 South Bay Dredged Material Disposal	18	250,000

POSSIBLE TIME SEQUENCING

	0	10	20	30	40	50	60
North Bay Dredged Material Disposal	xxxxxxxxx						
Baltimore Harbor Channel Enlargement			xxxxxxxxxxx				
Norfolk Harbor Channel Enlargement					xxxxxxxxxxxx		
South Bay Dredged Material Disposal							

B-128

COST ESTIMATE (Simplified)

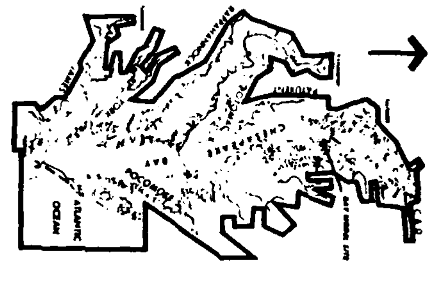
	North Bay Dredged Material Disposal	Baltimore Channel Enlargement	Norfolk Channel Enlargement
Labor			
Data Analysis and Report Writing			
Salt			
Subtotal	230,000	230,000	155,000
Operations & Maintenance	140,000	140,000	85,000
Individual Study Cost	370,000	370,000	240,000
Grand Total	$980,000.00		

The above approach assumes that since different channel configurations are needed for these tests, and since it is presumed that the configurations of channels have not been finally modeled, it would be practical to install the proposed channels first. Later changing to the models of existing channels would seem no more difficult than starting with existing channels and changing to proposed configurations later.

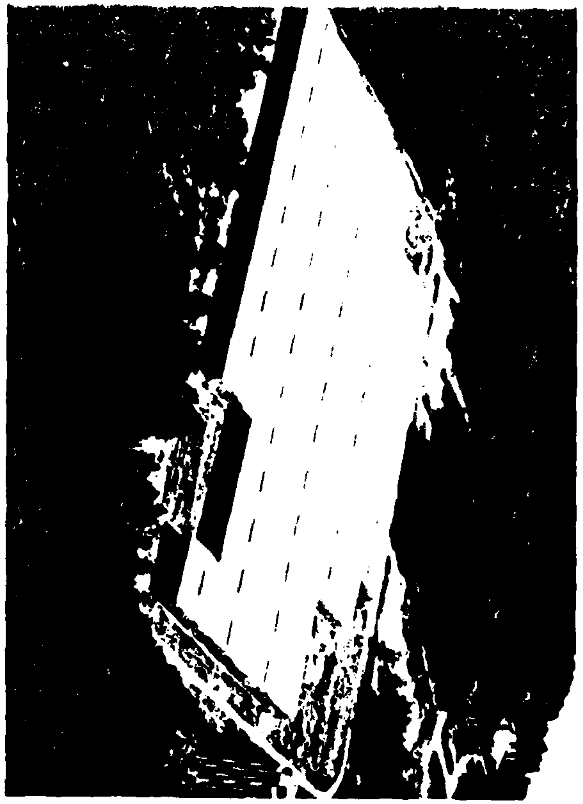
DEDICATION CEREMONY

Sponsored by the BOARD of COUNTY COMMISSIONERS of QUEEN ANNE'S COUNTY

Time: 2:30 p.m.
Date: Friday, May 7, 1976
Place: Matapeake, Maryland.
The Bay Model is located on Maryland Route 8 Approximately 2 miles south of the US Route 50 intersection.



LIMITS OF THE CHESAPEAKE BAY MODEL



The Chesapeake Bay Hydraulic Model will provide information necessary to plan for the wisest use of the Bay's water resources. Covering an area of 9 acres, the Bay Model is the largest estuarine hydraulic model in the world.

Baltimore District,
U.S. Army Corps of Engineers

THE CHESAPEAKE BAY HYDRAULIC MODEL

U.S. Army Engineer District, Baltimore
CHESAPEAKE BAY HYDRAULIC MODEL

DEDICATION CEREMONY

QUEEN ANNE'S COUNTY
1706

SPONSORED by the COUNTY COMMISSIONERS of QUEEN ANNE'S COUNTY ■ MAY 7, 1976

THE CHESAPEAKE BAY STUDY

Chesapeake Bay is the Nation's largest bay. The Chesapeake, her tributaries, and shoreline areas are rich in many natural resources, and our use of these water and land resources plays a vital role in the lives and economy of the Bay Region. But, the Bay is faced with many problems which threaten our continued use of her resources.

The Corps of Engineers' Chesapeake Bay Study is a comprehensive investigation into the people's needs and desires for the Bay's resources and the ability of the Bay to provide them. Working closely with the Corps on the Bay Study are other Federal agencies, the Bay Area States, and institutions and individuals who are concerned about Chesapeake Bay. These study participants include engineers, water resource planners, biologists, social scientists, and concerned citizens.

The single most valuable tool in studying the Bay will be the Chesapeake Bay *Hydraulic Model*. The Bay *Model* will reproduce to scale such physical characteristics as salinity, current speeds and directions, and tides. Through model tests, a more complete understanding of how this complex estuary operates will be obtained. Furthermore, model tests will be able to predict how proposed man-induced changes will alter the Bay's physical characteristics.

By applying the knowledge gained from the Chesapeake Bay Study and the hydraulic model, plans can be formulated that will insure a balanced approach to developing the Bay's numerous—but limited—resources while protecting her natural environment and beauty.

AGENDA

CHESAPEAKE BAY HYDRAULIC MODEL DEDICATION CEREMONY

Master of Ceremonies
John M. Ashley, Jr., President
Queen Anne's County Commissioners

INVOCATION

The Reverend Robert A. Gourlay

THE NATIONAL ANTHEM

INTRODUCTIONS

ADDRESS

Honorable Rogers C. B. Morton
Chairman, President Ford Committee

DEDICATING THE BAY MODEL

MUSICAL INTERLUDE

THE CHESAPEAKE BAY HYDRAULIC MODEL
Brigadier General Robert S. McGarry
District Engineer, Baltimore
U.S. Army Corps of Engineers

BENEDICTION

The Reverend Robert A. Gourlay

Following the ceremony, visitors are invited to tour the Chesapeake Bay Hydraulic Model at their leisure. *Guides are stationed around the model to answer questions.*

Music by
Queen Anne's County High School Band, Mr. John E. Peterson, Director
Queen Anne's County High School Chorus, Mrs. Nancy Cook, Director

BUILDING THE BAY MODEL

The Chesapeake Bay Hydraulic Model lies next to the bay that it duplicates. Land on Kent Island was donated by the State of Maryland for the model project.

A 14-acre shelter was designed and constructed to house the Bay Model. Construction began on the frame structure in 1973 and was completed in about 18 months. *The shelter is necessary to* protect the Bay Model from the wind, the rain, and debris that would adversely affect the precise measurements during testing.

While the shelter was being designed and constructed, the Bay's hydraulic characteristics that would be duplicated on the model were being monitored. Tidal elevations were recorded at 72 locations. Salinity and current speeds and directions were sampled at 750 locations. The 4 year Chesapeake Bay Data Collection Program was accomplished for the Corps of Engineers under contract by the National Ocean Survey, the Johns Hopkins University, the University of Maryland, and the Virginia Institute of Marine Science.

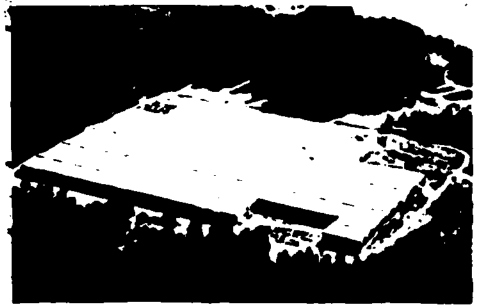
The first task in constructing the Bay Model itself was the plotting of the Bay's topography on masonite templates. The templates depict cross-sections of the Bay's topography at one-half mile intervals. Over 26 miles of templates were required.

After the templates were cut, placed, and set to the proper elevation, concrete was poured and graded to the configuration of the templates. Topographic details between templates were drawn in by sketchers who used the latest maps and nautical charts. Modeling craftsmen, following the sketchers instructions, then carefully hand-molded over six acres of the Bay Model. The last construction step was to imbed 700,000 metal resistance strips into the model.

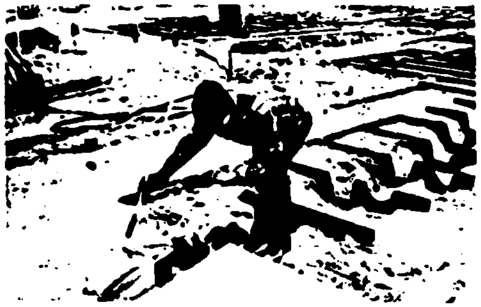
The completed Chesapeake Bay Hydraulic Model is the largest estuarine model in the world. It covers an area of 9 *acres and is 1,100 feet long and 680 feet* wide. Compared to the Bay, the Bay Model was built so that 1,000 feet of the Bay would equal 1 foot in the model horizontally, and 100 feet would equal 1 foot vertically. Given these scales, the 4-mile Bay Bridge is 21 feet long in the model. The deepest part of the model is 21 inches, which corresponds to a 175 foot depth off Kent Island. Since the Bay is generally shallow, however, two-thirds of the model will have a water depth of less than three inches.

Before the model is operational for tests, it will undergo a year of fine tuning and verification to insure that it accurately represents Chesapeake Bay's hydraulic characteristics. The resistance strips and water inflows from the model's Atlantic Ocean and tributaries will be adjusted so that the tides, currents, and salinity in the model conform to data that was collected during the Data Collection Program. Once it is verified, the Chesapeake Bay Hydraulic Model will be ready to help solve the Bay's most pressing problems.

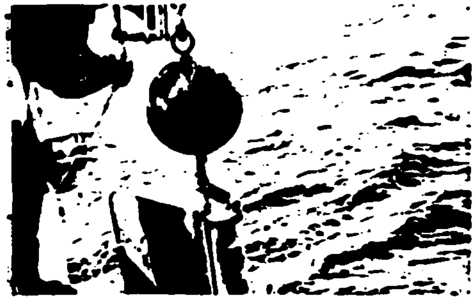
The 14-acre Chesapeake Bay Hydraulic Model Shelter.



Sketchers drew in topographic details between templates.

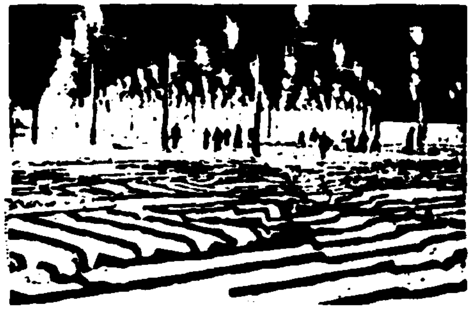


A current meter is placed during the Data Collection Program.



Six acres of the model were hand-molded by craftsmen.

Templates duplicate cross-sections of the Bay at one-half mile intervals.



The completed Bay Model is the largest estuarine hydraulic model in the world.

WALKING TOUR

1. The Tide Generating System. These structures are the heart of the hydraulic model in that they function together to generate tides in the model ocean. The lixator tank supplies brine solution to simulate ocean salt water. Salt water flows by gravity from the elevated water supply sump through the headbay into the model to simulate the flooding of the tide. In turn, water flows from the model, back through the headbay and into the return sump to simulate the ebb of the tide. A 12-hour tidal cycle in nature is reproduced in the model in approximately 7.5 minutes.

2. Pocomoke River. From this station we can see the Pocomoke River as well as the town of Crisfield, Maryland. This area is not only ecologically unique, but it also produces a sizable seafood harvest.

3. Salisbury, Maryland. Looking towards the west from this point, Salisbury, Md, and the Wicomico are important features of the Eastern Shore.

4. Cambridge and Easton, Maryland. Two of the larger residential and commercial communities located in Dorchester and Talbot Counties.

5. Kent Island, The Chester River, and Centreville, Maryland. This model is located on Kent Island. The town of Centreville is the county seat of historic Queen Anne's County.

6. The Chesapeake and Delaware Canal. The Chesapeake and Delaware Canal is a major artery of commerce connecting two important estuarine water bodies having different tidal regimes. To properly model the canal required the installation of another tidal control mechanism in Delaware Bay.

7. Conowingo Dam. The head of tide in the Susquehanna River is the Conowingo Dam. The Susquehanna provides approximately 50% of the total freshwater that flows into the system, exerting a profound effect on the salinity regime of the Bay. Freshwater simulating the flow of the river is introduced into the model through the adjustment of a valve at this point.

8. Water Treatment Plant. The water used during the operation of this model is pumped from a ground water aquifer that lies approximately 700 feet underground. As the water is highly mineralized, it has to be conditioned for both model and domestic use. This plant can provide up to 700 gallons per minute of water, enough for a town of 10,000 people.

9. Baltimore. The Port of Baltimore exerts great impact on the economy of the State of Maryland. The navigation channels and all piers have been meticulously formed in concrete as it presently exists. The approach channels are constructed so they can be altered, and studies will be made of the hydrodynamic effects of different navigation channel sizes and configurations.

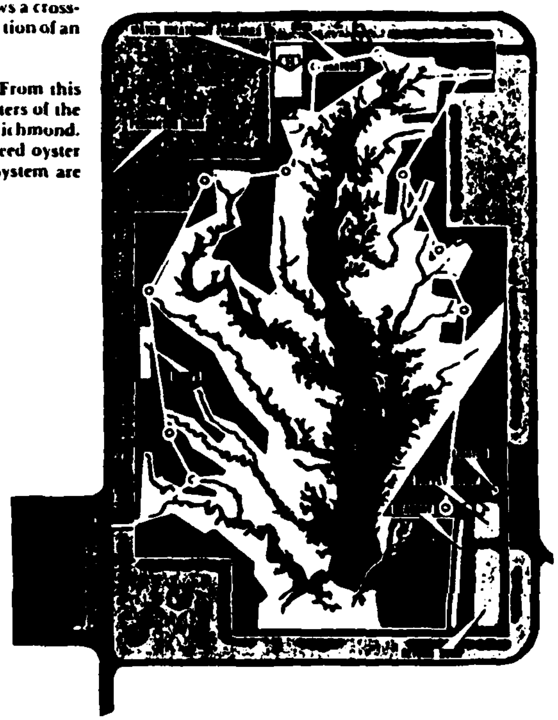
10. Annapolis, Maryland. The harbor of the State Capital, the Severn River, and the William Preston Lane Memorial Bridge as constructed in the model are visible from this station.

11. Washington, D.C. From this station we can view the Potomac River Estuary. This estuary is particularly important for the well-being of the Nation's capital city.

12. Fredericksburg, Virginia. At this station the Rappahannock River Estuary can be seen coursing southeastward towards Chesapeake Bay.

13. York River, Virginia. The Mattaponi and the Pamunkey Rivers meet at West Point, Va. to form the York River. The exhibit at this station shows a cross-section illustrating the construction of an estuarine hydraulic model.

14. Richmond, Virginia. From this station can be seen the headwaters of the James River *in the vicinity* of Richmond. Some of the most important seed oyster beds in the Chesapeake Bay System are located in the James.



THE COUNTY COMMISSIONERS OF QUEEN ANNE'S COUNTY

John M. Ashley, Jr., President
Julius Grollman, Commissioner   Leonard E. Smith, Commissioner

George W. Aldridge, Jr., Administrator
Robert R. Price, Jr., Esq., Attorney
Lynda H. Palmatary, Clerk
Jeannette S. Coleman, Deputy Clerk

U.S. ARMY CORPS OF ENGINEERS

Lieutenant General William C. Gribble
Chief of Engineers

Major General James L. Kelly
Division Engineer, North Atlantic

Brigadier General Robert S. McGarry
District Engineer, Baltimore

Colonel G. Harrison Hilt
Director, Waterways Experiment Station

SHELTER CONSULTANT

Whitman, Requardt & Associates

SHELTER CONTRACTOR

Charles E. Brohawn & Brothers, Inc.

Citizens Program for the Chesapeake Bay, Inc.

500 Esplanade,N. Apt.601
Venice,Fla.33595
Dec.13,1976

E.Gordon Riley
Industrial Consultant
Route 3,Box 368
Severna Park,Md.21146

Dear Gordon,

I have just received another set of four Future Conditions reports in the Corps of Engineers series.As you know,CPCB has a committment to review and comment on these. I have been reasonably successful in getting good responses from appropriate members on the earlier four drafts sent to us.

Would you be willing to review the draft report titled" Appendix 13,Electric Power",please? Or,if your time does not permit on such short notice,Can you arrange with another competent Engineer or "consumer" to do so? The Corps requests that comments be forwarded to William E.Trieschman Baltimore District Corps of Engineers,Box 1715 By Jan.7,1977,a rather unreasonable deadline for this time of year,I would say.

I am taking the liberty of asking the Corps to send you a copy of the Electric Power report to the above address. I will read and review this in-hand copy but more competent authority is needed in addition to my "consumer v'ewpoint". If you wish a copy be sent to someone else will you please contact Al Robinson,tel:962 2312 or Noel Beegle at 962 3410.

Thanks very much for your consideration and your help.

Sincerely,

Ed Aiton

✓cc: Alfred Robinson

Gordon's Telephone number is 301 647 3999

Citizens Program for the Chesapeake Bay, Inc.

BOx 324-A,Drum Point
Lusby, Md.20657
Aug.16,1976

CPCB SECRETARIAT
VPI&SU
322 Hutcheson Hall
Blacksburg
Virginia 24061

1976 OFFICERS AND EXECUTIVE COMMITTEE

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Cranston Morgan
Shellfish Institute of North America

Vice Chairman
Germaine Gallagher
League of Women Voters of Maryland

President & Chief Executive Officer
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Izaak Walton League

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Arthur Sherwood
Chesapeake Bay Foundation

Technical and Educational Advisory Group
L. Eugene Cronin
University of Maryland

Alfred E. Robinson,Jr.
Baltimore Dist.Corps of Engineers
P.O.Box 1715
Baltimore,Maryland,21203

Dear Al, Ref:NABPL-C

Thank you for arranging for transmittal of copies of your latest draft reports to me here.We will make an ernest effort to get citizen reaction for you on a broad front.Telephone conversations last week and again this morning with Noel Beagle were very helpful about overall stratogy of the report.If you have a draft of the topics and areas of concern that will be treated in future issues such a list would be helpful to me in our future reviews by CPCB. It would,I hope,minimize concerns about major voids such as the ones I mentioned to Noel this morning.

The draft Appendix on AGRICULTURAL WATER SUPPLY is excellent,in my opinion,and you are to be congratulated on the great improvement in this Future Conditions report over and above the treatment of Agriculture in the Existing conditions report that I saw,much earlier. Perhaps it is more detailed than will be appreciated by the average reader.But I was deeply impressed by its precise treatment and avoidance of misleading generalities.

I understand from Noel that future reports will deal with forestry and some aspects of Land Use.May I suggest that a contact with Dr.Frank Bentz,Vice Pres.for Agriculture,University of Maryland,College Park, would be fruitful for you.The Maryland General Assembly has commissioned a study on Preserving Agricultural Lands. The U of M is doing an in-depth job on this.Another good contact for Virginia is Dr.J.Paxton Marshall,Dept.Agric. Economics,Virginia Polytech. Inst.and S.U. at Blacksburg. A mention of CPCB or my name with each of these fellows in this context would be appreciated.

I think that some treatment of the weather and climate impacts of Agricultural vs.Urban or Industrial uses of land is needed in your study report somewhere. Oxygen consumption and excess CO2 are genuine concerns. The role of plant life as a cleanser may be significant.

Again congratulations on the Agricultural Water Supply report. I am truly regretfull that somehow I did not get into the action on it earlier but it appears to be in good hands.

We are making distribution of the Fish and Wildlife report and I may need to ask for more copies in order to arrange review in both Maryland and Virginia.

Sincerely yours,

E. W. Aiton

Edward Aiton,Pres.

Citizens Program for the Chesapeake Bay, Inc.

500 Esplanade,N. Apt.601
Venice,Fla. 33595
Dec.13,1976

Marvin J.Bennof,Exec.Secy.
Maryland Rural Affairs Council
Suite 4109, McKeldin Library
University of Maryland
College Park,Md.20742

Dear Marvin,

As you know,CPCB has a committment to review draft reports of the Corps of Engineers Future Condition Reports of the Chesapeake Bay Study,as these come out of their drafting rooms.It is volunteer work but important from the viewpoint of Citizen Participation in long-range management decisions.

Friday I received single copies of the latest, four,draft sectionsa Earlier we arranged review of four others.

Can you arrange review of two of these reports, titled"Noxious Weeds" and,"Flood Control",please? I am asking Charlie Coale to do the same at V PI. I will read and send comments also,on each of the four,but more competent authority is needed for this.

The Corps staff will arrange for review by all appropriate U.S.Government agencies,so please do not ask such groups to help,via our auspices. Research departments of the University would be OK,I think,if the respose mentions this request from CPCB.

I am taking the liberty of having the Corps staff send a copy of each of these two draft reports to you,for your action,since time is regretably short for this crowded Holiday season.Perhaps you can save even more time for review by contacting the Corps by phone. Telephone either Alfred E.Robinson, 301 962 2512,or Noel Beegle,301 962 3410, both in Baltimore.

Thank you very much for your consideration.I hope that all is well in your diggings,as it is with Helen and me here.

Sincerely yours,

Edward Aiton,Pres.

cc: Alfred E.Robinson

Dear Al,
Bennof's phone is 301 454 5486

FILE w/letter
comment letter in FCK

Citizens Program for the Chesapeake Bay, Inc.

500 Esplanade,N.Apt.601
Venice,Fla.,33595
Dec.13,1976

CPCB SECRETARIAT
VPI&SU
322 Hutcheson Hall
Blacksburg,
Virginia 24061

1976 OFFICERS AND
EXECUTIVE COMMITTEE

EDWARD J.Vinnicomb
McCormick Road
Cockeysville,Md.,21030

Dear Ed,

Probably you know that CPCB has a committment to the U.S.Army Corps of Engineers to assist in the public review of their reports and management appraisals connected with their Future Conditions reports in their Chesapeake Bay Study. In past months we have been sent draft copies of four sections and I have arranged with appropriate members or affiliates of CPCB for them to criticise or comment on the / proposed content and recommendations.

Now four more sections are ready and I have one of each for review.One of these is Appendix 9,Navigation With your long and wide experience in this important field,would you be willing to review a copy and send comments to Mr.Alfred E.Robinson,asper the enclosed copy of their transmittal letter,please?Or, if you cannot do it on such short notice,can you refer it to another competent person who will? It is unfortunate that so little time is allowed for this,in view of the Holiday season crush. I will read and review it too, but my experience is inadequate for a significant contribution in this area of vital concern to Bay users.

I am taking the liberty of asking that another review copy of this report be sent directly to you from the Corps office in Baltimore.I am not advised of the mail address you listed on your recent, welcome membership contribution. Hence I hope that Mrs.Flannery will be our intercediary for this. Maybe you are enjoying the sanity of Eastern Shore congeniality and leisure????

Thank you for your consideration of this request. We feel that citizen review of these proposals is,of course,aburdenon volunteers (who have no secretaries and can't type well either) but hopefully it is a worthy purpose.

Very truly yours,

Ed

Edward Aiton,Pres.

cc:Alfred Robinson
Mrs.Flannery
Charles Coale

Telephone number for Vinnicomb is 539 6460

Citizens Program for the Chesapeake Bay, Inc.

500 Esplanade,N, Apt 601
Venice, Fla. 33595
Feb.9,1977

Mr. Noel Beegle
Dept. of Army,Corps of Engineers
Chesapeake Bay Study Program
P.O. Box 1715,Baltimore,Md. 21203

Dear Noel,

I received recently one copy each of final drafts of Future Conditions Reports on Shoreline Erosion and Study Organization ,History and Coordination. I will send a review of the Shoreline Erosion Appendix very soon. At this stage in your program it would seem futile to inject suggestions into the Appendix I subject so we will not attempt to review it.

In order to facilitate a rapid review of the Shoreline Erosion Appendix 11 will you please have your staff send review copies to the following:

2 copies to: Dr.Charles Coale
Rm.322 Hutcheson Hall,Va.Polytech.Inst.
Blacksburg,Va. 24061

2 copies to: Marvin J.Bennef,Exec.Secy.
Maryland Rural Affairs Counsel
Suite 4109, McKeldin Library
University of Maryland
College Park,Md. 20742

1 copy to: E.Polk Kellam,Jr.
Belle Haven
Virginia,23306

I trust that our folks in CPCB will be able to send you pertinent reactions and suggestions on this draft report.But I doubt that all reviews can be returned to William E.Trieschman by 21 February,1977,as requested by him in his transmittal letter,dated Jan.19,1977. Obviously the U.S. Maild are not operating that fast,these days.

Sincere best wishes,

EA

Edward Aiton,Pres.

Citizens Program for the Chesapeake Bay, Inc.

500 Esplanade,N. Apt 601
Venice,Fla. 33595 March22,1977

William E.Trieschman, Jr.,Planning Division
Baltimore Dist.,Corps of Engineers
P.O.Box 1715
Baltimore,Md. 21203

RE: Ches.Bay Future Conditions Report
Appendix 7, Water Quality

Dear Sir,

Your letter dated 15 March enclosing the above draft report plus two others,arrived here yesterday. I hope to have my review of it in the mail in a couple of weeks.

In accordance with our previous arrangement,please send additional review copies to the members of CPCB listed below.Hopefully theymay be able to send their comments directly to you by your too rapidly approaching deadline of 8 April,1977.

Cranston Morgan,Shellfish Institute of No.America
Box 193
White Stone, Va. 22578

George Hagerman,Pres.
Virginia Conservation Council
6007 Oceanfront Rd.
Virginia Beach,Va. 23501

Dr.Charles Coale
322 Hutcheson Hall,Dept.Agric.Econ.
Virginia Polytech.Inst.&S.U.
Blacksburg,Va. 24061

Mrs.Ajax B. Eastman,Junior League of Baltimore
112 East Lake Ave.
Baltimore,Md. Md. 21212

Dr.Elwin Deal, Coop.Extension Service
1215 Symons Hall
University of Maryland
College Park,Md. 20742

E.Gordon Riley,Industrial Engineer
410 Henderson Rd.
Severna Park,Md. 21146

Best Wishes,

E.W. Aiton

Edward Aiton,Pres.

Citizens Program for the Chesapeake Bay, Inc.

500 Esplanade,N. Apt 601
Venice,Fla. 33595
March 22,1977

William E.Trieschman,Jr.
Chief,Planning ~~Section~~ Division
Baltimore District,Corps of Engineers
P.O.Box 1715
Baltimore, Md. 21203

Dear Sir.,

RE:Ches.Bay Future Cond.Report
Appendix 5,Municipal and Industrial
Water Supply

With your letter dated March 15,I received yesterday a copy of the above report along with two others. I hope to have a copy of my review and suggestions within a couple of weeks.

Asper previous arrangement with Noel Beegle, please transmit additional review copies directly to the members of CPCB listed below.I am not confident that all of them can meet your deadline 8 April,1977. I trust that each will review this draft personally or arrange for a specialized associate to do so and send reactions directly to you as soon as possible.

E.Gordon Riley,Industrial Engineer
~~Box 2 Box 268~~ 410 Henderson Rd.
Severna Park,Md. 21146

Edward J.Vinnicomb
Box ~~219~~ 217
Oxford, Md. 21654

Mrs.Ajax Eastman
112 East Lake Ave.Baltimore.Md. 21212

George Hagerman,Pres.
Virginia Conservation Council
6007 Oceanfront Rd.
Virginia Beach,Va., 23451

Dr.Charles Coale
322 Hutcheson Hall,Dept. Agric. Econ.
Virginia Polytech.Inst. & S.U.
Blacksburg,Va. 24061

Sincere Best Wishes,
E. W. Alton
Edward Alton,Pres.

Fil. Review FOR

Citizens Program for the Chesapeake Bay, Inc.

CPCB SECRETARIAT
VPI&SU
322 Hutcheson Hall
Blacksburg
Virginia 24061

1976 OFFICERS AND EXECUTIVE COMMITTEE

Chairman
Cranston Morgan
Shellfish Institute of North America

Vice Chairman
Germaine Gallagher
League of Women Voters of Maryland

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Industrial Consultant

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Betty Jane Gerber
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Barbara Fine

Treasurer
J. Paul Williams

At Large
F. Polk Kellam
William C. Lunsford, Jr.
Arthur Sherwood

E. Eugene Cronin
University of Maryland

500 Esplanade N. Apt.601
Venice, Fla. 33595
March 22 1977

William E. Trieschman,Jr.
Chief, Planning Section
Baltimore District,Corps of Engineers
Box 1715
Baltimore,Md. 21203

Re: Draft Chesapeake Bay Study Report
Appendix 2,Public Part.& Inf.

Dear Sir:

Yesterday I received a copy of the above draft report,along with others,for review by our organization. I will have my reactions in the mall within a couple of weeks.

Asper previous arrangement with Noel Beegle and Ted Robinson, please send additional review copies to the members of CPCB listed below.

I am not sure that they can all meet your deadline date 8 April,1977. But I am confident that these persons can either offer good counsel themselves or arrange for a worthy reaction by specialized persons associated with them.

George Hagerman,Pres.,Va.Conservation Council
6007 Oceanfront Rd.,
Virginia Beach,Va. 23451

Betty Jane Gerber,Junior League of Washington
1309 Ballantree Ct.
McLean,Va. 22101

Dr.Charles Coale, Dept.Agric.Economics
322 Hutcheson Hall
Virginia Polytech.Inst.&S.U.
Blacksburg, Va. 24061

Mrs.Ajax B. Eastman,Junior Leagueof Baltimore
112 East Lake Ave.
Baltimore,Md. 21212

Dr. Elwin Deal, Coop.Extension Service
University of Maryland
1215 Symons Hall
College Park, Md. 20742

Sincere regards and Best wishes,
E. W. Alton
Edward Alton,Pres.

NABPL-C 24 March 1977

MEMO TO THE FILE

SUBJECT: Meeting with SRBC on Low Flow Test

1. On 23 March 1977, Mr. Alfred E. Robinson, Jr., and the undersigned attended a meeting at the Susquehanna River Basin Commission's offices in Harrisburg to discuss the proposed Low Freshwater Inflow Model Study. A list of attendees is attached.

2. Mr. Robinson started the meeting by giving some background on the study and describing the Low Flow Study. He pointed out that the main objective of this study was not to determine the effects of consumptive losses on the Bay but rather to determine how salinities in the Bay react to decreases in freshwater inflows.

3. Mr. Goulding then expressed the new regulation in the Basin which states that each water user must make up the water which he consumes, over and above that consumed in 1971, when the flow of the river of the point of intake drops below the 7-day 10-year flow. Mr. Goulding felt that the flows in the Susquehanna River during the low flow test should be indicative of what might occur under this new regulation rather than to decrease the flows by the entire projected consumptive losses.

4. Mr. Robinson explained that this would be improper because of two reasons. First, since the flows in the remaining tributaries will be depressed by the projected losses, the flows in the Susquehanna River should be simulated using the same criteria. Secondly, if someone were to test or fight the new regulation or take it to court, information would be needed as to the effects of depressed flows on the Bay assuming the regulation was not in effect. Mr. Robinson further explained that the second phase of the study in which only the Susquehanna River flows will be depressed should not be changed since this will be needed to isolate the effects of the Susquehanna River from the total effects as determined in the first phase.

5. Mr. Goulding agreed and suggested that a third test be added to the Low Flow Study in which the new Pennsylvania regulation would be tested. It was agreed that this would be best but that the test would have to be funded from outside of the Corps. Mr. Goulding said he would send a letter to the district requesting this additional test and a cost estimate.

6. It was further suggested that during the first phase of the study, the annual average hydrographs following the 3 years of depressed hydrograph also be depressed since this would simulate a more realistic condition. Mr. Robinson felt that this was a good idea and said that he would investigate it further.

7. The proposed consumptive losses and diversions to be used in the study were then reviewed. Many of those at the meeting felt that most of the figures were high. Mr. Goulding said that SRBC would provide this office with updated figures by the end of June.

Diering

JOHN C. DIERING
Chesapeake Bay Study Branch

1 Incl
as

SUSQUEHANNA RIVER BASIN COMMISSION
5012 Lenker Street • Mechanicsburg, Pennsylvania 17055

From the Office of the Executive Director

May 31, 1977

Colonel G.K. Withers, District Engineer
Baltimore District, Corps of Engineers
Department of the Army
P. O. Box 1715
Baltimore, MD 21203

Dear Colonel Withers:

On March 23, 1977, at the request of the Chesapeake Bay Study Branch of your office, we hosted a meeting of interested state and Federal agencies to discuss matters pertinent to the forthcoming testing program on the Chesapeake Bay Hydraulic Model. The discussion focused primarily on the proposed Low Fresh Water Inflow Study and the need for determining and providing consumptive water use data for the Susquehanna River Basin as input of vital interest and substantial significance in this first test program.

The SRBC staff along with other interested agencies had previously provided comments to your office with respect to the overall testing program elements and scheduling. There has seemingly been concurrence by everyone on the proposed two-phase testing procedure outlined for the Low Fresh Water Inflow Study. Based on the discussion at the meeting and on information subsequently received in this office from Pennsylvania and Maryland, we would like to take this opportunity to comment on several aspects of the study dealing first with the basic data inputs being considered relative to consumptive water use in the Susquehanna River Basin.

We have prepared the attached table which summarized consumptive water losses throughout the basin using the best available information for current usage as of the year 1975, and projected usage for the target year 1990. We have separated consumptive loss attributable to the electric power industry and aggregated consumptive losses for all other purposes including out-of-basin diversions. We have chosen the projected target year of 1990 as being the most reasonable point to which we can ascribe with any certainty the levels of water use and loss projections. Concern has been expressed regarding the very wide

variance between figures projected by your office and those which have been determined by the Commonwealth of Pennsylvania. It is our understanding that the Pennsylvania data resulted from a fairly recent and rather extensive questionnaire effort and tends to support the current as well as projected levels of use and losses noted herewith. Similarly, we have drawn from data provided by the State of Maryland and the State of New York.

Overall, the water loss data for the electric power industry has been drawn from the Master Siting Study conducted by the electric utility industry and provided to the SRBC. An updating of this study will be available June 9, 1977 and any significant modifications of data will be provided as quickly as possible.

At the March 23rd meeting, our staff raised the prospect of having your program consider a third phase in the Low Fresh Water Inflow Study. We assume that the initial studies might show that projected levels of consumptive losses in the Basin could have a marked effect on salinity levels in the Upper Chesapeake Bay. The model testing program as presently structured does not take account of the recently adopted SRBC consumptive loss makeup criterion. Our objective in proposing an extension of the initial test program would be to determine the effect of the SRBC Regulation on salinity and other quality or quantity parameters of concern to the Upper Chesapeake Bay.

In discussion with Mr. Alfred E. Robinson, Jr., Chief, Chesapeake Bay Study Branch, Baltimore District, Corps of Engineers, it was agreed that the SRBC staff would provide a proposed outline of model testing objectives and procedures that would be evaluated by your staff and a general cost estimate derived to accomplish this additional model investigation. We have developed the material as agreed and would appreciate your review and evaluation relative to the possibilities of conducting such a test in the event that the appropriate agreements and funding support can be achieved.

We greatly appreciate the opportunity afforded us to continue participation in this very worthwhile and essential model testing program. If, at any time, there is need for additional information or input from the SRBC, please don't hesitate to contact me.

Very truly yours,

Robert J. Bielo
Executive Director

Attachments

THE COUNTY COMMISSIONERS

OF QUEEN ANNE'S COUNTY

CENTREVILLE, MARYLAND 21617

PHONE 758-0322

LEONARD E. SMITH PRESIDENT
JULIUS GROLLMAN
JOHN M. ASHLEY JR

GEORGE W. ALDRIDGE JR ADMINISTRATOR
LYNDAH PALMATARY CLERK
ROBERT R. PRICE JR ATTORNEY

July 7, 1977

Col. G. K. Withers, District Engineer
Baltimore District, Corps of Engineers
P. O. Box 1715
Baltimore, MD 21203

Dear Colonel Withers:

June 17th, 18th and 19th, 1977, were days which will be long remembered and appreciated by the Citizens of Queen Anne's County. The events of Queen Anne's Days, 1977, were conducted in a precise, professional, flawless and dignified manner. We have had hundreds of compliments on the conduct of the activities, as well as dozens of written communications praising this historical success. Our guest of honor, Her Royal Highness The Princess Anne, commented several times that she had never seen a program more efficiently planned and executed.

Queen Anne's Days could not have been a success without the cooperation and team work of many. Interested, dedicated citizens did the right things in the correct ways at the right times.

You and your department were major contributors to the perfect execution of Queen Anne's Days, 1977. Please convey our appreciation and commendation to every member of your organization who had a part in these events. They have our sincerest admiration for making the Queen Anne's Days, 1977, a memorable success. Their extended efforts will be remembered by Queen Anne's Countians for generations to come.

Yours very truly,

THE COUNTY COMMISSIONERS
OF QUEEN ANNE'S COUNTY

LEONARD E. SMITH, PRESIDENT

JULIUS GROLLMAN

JOHN M. ASHLEY, JR.

CC:bap

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS
P O BOX 1715
BALTIMORE, MARYLAND 21203

REPLY TO ATTENTION OF

NABPL-C

19 August 1977

TO ALL PARTICIPANTS, CHESAPEAKE BAY STUDY

The second or future projections phase of the Corps of Engineers Chesapeake Bay Study has been completed. Inclosed for your use in this study are the appendices to the Chesapeake Bay Future Conditions Report. Appendices 1 and 2 (Volume 2) contain information describing the history and conduct of the study and the manner in which the study was coordinated with the various Federal and State agencies, scientific institutions, and the public. Appendices 3 through 15 (Volumes 3 through 11) each contain information on specific water and related land resource uses to include an inventory of the present status and expected future needs and problems. Appendix 16 (Volume 12) focuses on formulation of the initial testing program for the Chesapeake Bay Hydraulic Model. The Summary Report is currently under review and will be contained in Volume 1 of the Future Conditions Report. That volume will be forwarded shortly.

Any comments or requests for additional information on this Report should be directed to Mr. Alfred E. Robinson, Jr., Chief, Chesapeake Bay Study Branch.

Sincerely yours,

WILLIAM E. TRIESCHMAN, Jr.
Chief, Planning Division

Incls
As stated

NABPL C 22 November 1977

Mr. Robert J. Bielo
Executive Director
Susquehanna River Basin Commission
1721 North Front Street
Harrisburg, Pennsylvania 17102

Dear Mr. Bielo:

This is in response to your letter of 31 May 1977 concerning the Chesapeake Bay Low Freshwater Inflow Study proposing an additional set of freshwater inflow conditions to be simulated on the hydraulic model.

In your letter, you expressed concern over the wide variance between the projected consumptive losses computed by this office and those which were determined by the Commonwealth of Pennsylvania. The reason for this apparent difference is that the figures determined by Pennsylvania were yearly averages, while those computed by this office are monthly values which reflect seasonal variations in demands and losses. However, when both sets of figures are compared on the same basis, the difference is not so great. For example, for our year 2000 projections, the total yearly average for diversions, municipal and industrial losses, and irrigation is 864 cfs. When compared to your year 1990 projections of 906 cfs which excludes the 172 cfs loss for power production, the difference is less than 5 percent. On the other hand, it is agreed that there is a large difference between the projected losses for electric power production, and our figures will be adjusted based on the 9 June 1977 Master Siting Study.

It should be noted that in order to perform a more comprehensive analysis of the effects of depressed freshwater inflows, the incremental differences between the flows in the Base and Plan Tests should be as large as possible, but still consistent with real world probabilities. For this reason, the Chesapeake Bay Study Steering Committee and Advisory Group both recommended that the maximum conceivable consumptive losses for the year 2020 be used. Since the primary objective of the Low Flow Test is to reflect a wide incremental flow regime with consumptive losses being used only as a guide,

NABPL-C 22 November 1977
Mr. Robert J. Bielo

this office feels that the projected year 2020 losses, as presented during the meeting held in your office on 23 March 1977 should be used to depress the flows in the Low Flow Test. It is agreed, however, that the projected loss for power production for the year 2020 will have to be revised. This work will be coordinated with your office.

Your letter proposed a third phase of the Low Freshwater Inflow Study utilizing the historic flows of 1929 through 1933. In our Low Freshwater Test, however, we are using an inflow hydrograph based on historic 1929 through 1931 inflows followed by two computed average year inflow hydrographs. We will use the data collected from the model during the flows simulating the 1929-1931 time period to determine the effects of drought flows on the system, while an estimate of estuarine recovery time will be derived from data collected from the model during the two average inflow year hydrographs. The average year hydrograph will also be used to determine if the possibility of permanent change in the salinity regime exists. You may wish to consider the possibility of substituting average inflow hydrographs for the last two years of your proposed testing scheme. This will provide a common base to which the resulting model test data can be compared.

Based on the description of the test as described in your letter our best estimate at this time to perform the work is between $115,000 and $130,000. It should be noted that some cost savings due to model preparation time could be realized if this test is performed immediately after the second phase of our proposed study. This estimate is also based on the assumption that all of the freshwater inflow data required for the model test will be provided by your office.

It is requested that this office be informed as soon as practicable as to your intentions concerning the proposed Phase III test. If you have any questions or need further information, please call Mr. A. E. Robinson, Jr., at (301) 962-2512.

Sincerely yours

WILLIAM E. TRIESCHMAN, Jr.
Chief, Planning Division

CF: Patrick J. Delaney

NABPL-C

Mr. Gerald R. Calhoun
State Conservationist, Maryland
Room 822, Hartwick Building
4321 Hartwick Road
College Park, Maryland 20740

[illegible] 1978

Dear Mr. Calhoun:

The second or future projections phase of the Corps of Engineers Chesapeake Bay Study has recently been completed and the Chesapeake Bay Future Conditions Report, which describes the findings of this second study phase, has been distributed. During the third and final study phase, solutions to high priority problems will be formulated and recommended based on testing conducted on the Chesapeake Bay Hydraulic Model.

Inclosed for your review and comment is the final draft of the Chesapeake Bay Study Revised Plan of Study which provides a detailed description of the work to be accomplished during the final study phase. This Draft is currently under review by the Office, Chief of Engineers and, until approved by that office, the contents of the draft are not available for public use.

You are invited to attend a meeting of the Chesapeake Bay Study Advisory Group on 27 April 1978 to discuss the Revised Plan of Study and the final phase of the Chesapeake Bay Study. The meeting is scheduled to begin at 9:30 AM in Room G-30 of the Federal Office Building, 31 Hopkins Plaza, Baltimore Maryland.

I look forward to meeting you and hearing your comments with regard to this document and the final phase of our study. Should you have any questions concerning this matter, please do not hesitate to call me or Mr. Alfred E. Robinson, Jr., Chief, Chesapeake Bay Study Branch at (301) 962-2512.

Sincerely yours,

G. K. WITHERS
Colonel, Corps of Engineers
District Engineer

1 Incl
As stated

COMMONWEALTH OF PENNSYLVANIA

DEPARTMENT OF ENVIRONMENTAL RESOURCES
P. O. BOX 1467
HARRISBURG, PENNSYLVANIA 17120

In reply refer to
RM-R
F 70:4 B
Your Ref. NABPL-C

March 30, 1978

Colonel George K. Withers, Jr.
District Engineer
Baltimore District - Corps of Engineers
P. O. Box 1715
Baltimore, Maryland 21203

Attention: Alfred E. Robinson, Jr.

Dear Colonel Withers:

On March 14, 1978, your office sent us a copy of the Summary Report to the Chesapeake Bay Future Conditions Report, and stated that the future projections contained therein will be the basis for the plan formulation phase of the Chesapeake Bay Study. We appreciate being kept informed of the study's progress.

Our interest continues in the anticipated inflows from the Susquehanna River for maintaining the Upper Bay biota. We are, consequently, looking forward to the results of the Chesapeake Bay Model studies of salinity, particularly the effects of Chesapeake and Delaware Canal enlargement and the 500 MGD withdrawal for Baltimore's water supply needs.

We find the Summary Report an exceptional document in clarity, conciseness and completeness, and an excellent basis for the final phase of the Study.

Sincerely yours,

C. H. McConnell

C. H. McConnell, Deputy Secretary
Resources Management

Citizens Program for the Chesapeake Bay, Inc.

CPCB SECRETARIAT
VPI&SU
322 Hutcheson Hall
Blacksburg,
Virginia 24061

500 Esplanade,N.Apt.601
Venice,Fla.33595

April 2,1978

Alfred E.Robinson,Jr.,Chief
Chesapeake Bay Study Branch
Baltimore District,Corps of Engineers
P.O.Box 1715
Baltimore,Md. 21203

Dear Ted and Staff,

Thanks to you and your staff for arranging that I receive a set of the final draft Future Conditions Reports and Appendices.Also we note that copies were sent to Mssrs. Morgan,Valliant and Hagerman.

I have re-read enough of them to find that this draft contains substantial improvements ,including many that we commented about in our reviews by CPC members and associates.

It appears to me that these documents comprise an excellent base-line review for future planning and management activities related to th Bay.I am sure that we in CPCB will find the reports exceedingly useful and I hope that the several agencies will be spared the nessity of starting from zero base.

It has been a very pleasant winter for Helen and me here in Venice.We ecxpect to follow the swallows north to Lusby about the first of May.

Thanks again for your consideration.We appreciate the several mentions of CPCB in your sections onPublic Participation.

Very truly yours,

Edward Aiton

cc: Morgan,
Valliant
Hagerman

NABPL-C

5 June 1978

SUBJECT: Meeting with the Maryland Coordinator for the Citizens Program for Chesapeake Bay's Public Involvement Program and the Coordinator for the Maryland Coastal Zone Management's Public and Local Government Participation Program

MEMORANDUM TO THE FILE

1. On 1 June 1978 the undersigned met with Mrs. Frances Flanigan, Maryland Coordinator for the Citizens Program for Chesapeake Bay's Public Involvement Program, and later with Mr. Scott Brumburgh, Coordinator for the Maryland Coastal Zone Management's Public and Local Government Participation Program. The purpose of the meetings was to discuss the formulation of the Chesapeake Bay Study Public Involvement Program for the final study phase. [It should be noted that the Citizens Program for Chesapeake Bay (CPCB) has been contracted by EPA to conduct the public involvement program for its Chesapeake Bay Program].

2. There were three major objectives to be reached at each meeting. These included:

a. To further determine who the interested and affected public is with regard to related water resources studies in the Region.

b. To determine what means and mechanisms have been used effectively in other public participation programs to involve the public.

c. To determine the best means available to coordinate the Chesapeake Bay Study Public Involvement Program with other related programs.

3. During the meeting with Flanigan, the following major points and comments were raised:

a. EPA will soon be contracting for an assessemnt of "user-needs" in the Chesapeake Bay Region in connection with its study. This assessment will be aimed at individuals who are not as vocal or as well known as those people traditionally identified as having an interest in Chesapeake Bay. The survey will determine who the users are and what their needs are. This information should prove useful to our study. Flanigan will provide us more information on the assessemnt when it is available.

b. CPCB is currently computerizing a mailing list for the EPA study. This list has been compiled from mailing lists provided by each of the five CPCB regional offices set up to administer the public involvement program. Flanigan can make this list available to us upon request.

c. The Baltimore Environmental Center (a private environmental group) is composing a handbook containing descriptive information on State, regional, and local organizations and citizens groups. Flanigan will check on the status of this handbook and attempt to get us a copy or find out how we can order it. The handbook will be useful to us in further identifying who the interested public is.

d. An easy and effective means of advertising public meetings is to put out a "flier" (Inclosure 1) announcing time, place and purpose of meeting. Mass distribution is made to concerned organizations and groups who in turn will further distribute to their members.

e. Newsletters, distributed to mailing list entries, are one of the best ways of informing the "concerned" public about a study. Flanigan indicated that at least two newsletters currently in existence are available to us for disseminating information on the Chesapeake Bay Study. These are the Maryland Coastal Zone Management's (CZM) <u>Coast and Bay Bylines</u> and CPCB's <u>Chesapeake Citizen</u> (a bimonthly initiated in April/May 1978). Within a year, Flanigan hopes to have initiated a "bay-wide" newsletter which would include information on all studies being conducted within the Bay Region. It is expected that EPA will initially fund this newsletter. At the conclusion of EPA's Study, however, some other organization will have hopefully taken over publication responsibilities.

f. Flanigan indicated that while public meetings are not always well attended, they do serve a useful purpose by helping to build an important rapport with interested members of the public.

g. Public involvement is a two-way process - first, to inform the public about a study, and second, to elicit certain information concerning needs and desires from the public. Flanigan maintains that there are in turn two ways to inform the public about a study - First, through general or "awareness" information where no response is required. Such information is found in newsletters, news releases, brochures (See Inclosure 2), tabloids distributed to weekly or monthly newspapers for inclosure in their publication (according to Flanigan, weekly and monthly newspapers are generally more receptive than daily newspapers to information on studies similar to the Chesapeake Bay Study); and fact sheets (to be distributed to libraries and to the interested public at meetings). The second way is through draft reports, questionnaires and surveys where a response is both important and expected. There are also a number of ways to gather information from the public. One of the most effective ways Flanigan has used is an informal "Ad Hoc" committee convened for the special purpose of obtaining input on a specific issue or to "bounce ideas off of". Another existing group which Flanigan feels is very representative

and available for use in an advisory capacity is the Coastal Resources Advisory Committee (CRAC), a group set up as part of the Maryland CZM program to help in identifying and addressing the public's needs and concerns related to coastal zone issues.

h. Workshops can be useful tools in eliciting public response, however, certain disadvantages exist. They are very time consuming and dissatisfaction may occur if the participants feel that their views are not being properly considered. Flanigan indicated that she herself has not had personal experience with workshops. Brumburgh, however, is a good source of information since he organized several workshops during the early formulation stage of the Maryland CZM program.

i. CPCB has utilized representative libraries throughout the Region to send not only reports but any other useful information on EPA's Chesapeake Bay Program. The libraries have been requested to place all of this plus any other Bay-related materials together in one location. The undersigned explained that the <u>Chesapeake Bay Existing Conditions Report</u> and <u>Future Conditions Report</u> have been similarly distributed to libraries. Flanigan urged that any other useful information be sent to these libraries in order to increase information available on the Bay.

j. In terms of coordination of public involvement programs, Flanigan was very receptive to our making use of CPCB's Public Involvement Program for our needs. For example, she encouraged us to provide information for CPCB's newsletter. She also suggested that the Citizens' Steering Committee established by EPA for their Chesapeake Bay Program be used as an "Ad Hoc" Committee in order to provide us with public input on alternatives, recommendations or impacts. Flanigan indicated that a major concern of hers was that we not duplicate efforts of other organizations such as CPCB or Md. CZM in the area of public involvement but rather that we dovetail our activities wherever possible. She maintained that citizens would be more eager to cooperate with agencies if they felt there was coordination of efforts between these agencies.

k. Due to the nature of our final study phase, Flanigan suggested that we may wish to keep our public involvement program at a low-key, primarily informational level during the next year or two. At that time more intense public input would be required for alternative assessment and we could then elicit public response. By not "psyching" the public up into expecting immediate results is advisable to promising them an active public involvement program which we cannot deliver at this time. The undersigned indicated that the public involvement acitivities requiring active public participation would not occur until the latter part of FY 80 when our first workshops are scheduled.

SUBJECT: Meeting with the Maryland Coordinator for the Citizens Program for Chesapeake Bay's Public Involvement Program and the Coordinator for the Maryland Coastal Zone Management's Public and Local Government Participation Program

1. One of the major goals of the CPCB public involvement program is to develop a public involvement program which will last far beyond EPA's Chesapeake Bay Program and deal with all of the studies and on-going programs affecting Chesapeake Bay. By our coordinating our public involvement efforts with those of CPCB and the Md. CZM program a major step will be taken toward achieving this goal.

4. During the meeting with Brumburgh, the following major points and comments were raised:

a. The Maryland CZM program has compiled a list of about 5,000 names for their mailing list. This can be made available to us upon request.

b. Brumburgh is preparing a handout containing information on those citizens committees which have been given a mandate to accomplish some ~~change~~ duty. Groups to be included are CRAC, 208 Regional Planning Advisory Committees (3 Committees are being established, one for the Baltimore Metropolitan Area, one for the Washington, D.C. metro area, and one for the rest of the State), and the Metropolitan Advisory Board (a collection of governments, government agencies, and citizens groups with a common interest in effective coastal zone management in the Baltimore Region). He will provide us with this information which will include how the group works, what its duties and responsibilities are, who belongs to the committee, what the committee's future activities will be, what its legislative mandate is, its source of funding, its major accomplishments, who its chairman or director is, who the lead agency is, and how it cooperates with the bodies. Information on these committees should prove useful to us in defining both who the interested public is and how they become informed. A draft of the handout should be available by the end of June.

c. Brumburgh will send us a list of the most active State and regional groups with whom he has worked in connection with the CZM program. This will also constitute an important portion of the interested public within Maryland.

d. Brumburgh reinforced Flanigan's convictions that CRAC represents a group with strong ties to citizens groups, planning staffs, local government officials, special interest groups, and State and Federal governments. As such, it would serve as an excellent means for us to disseminate information to the public and to gather public input concerning impacts, alternatives, and recommendations. He urged that we use this group in an advisory capacity because it is well established, has been given certain legal powers, and is quite representative of the interested public. He indicated that the Soil Conservation Service will be asking CRAC to provide input into one of its programs and that the same could eventually be done by us.

SUBJECT: Meeting with the Maryland Coordinator for the Citizens Program for Chesapeake Bay's Public Involvement Program and the Coordinator for the Maryland Coastal Zone Management's Public and Local Government Participation Program

e. Brumburgh has organized and participated in a series of workshops held early in the formulation of the Maryland CZM Program. He indicated mixed feelings concerning the success of these workshops. They are very difficult to carry-off effectively and require a great amount of skill to organize and conduct. One of the most difficult tasks is to get across to the participants that the input they are providing will be considered in the decisions being made but that the input will not be blindly or automatically incorporated into the planning process.

f. Brumburgh is planning to use a "delphi" approach of obtaining information from the public. With this method of public involvement, a representative group of interested people are sent questionnaires. They fill out the questionnaires and mail back. The responses are analyzed and reported in a second questionnaire. The process is repeated several times until a consensus from the group is reached. Brumburgh believes the method may be useful in clarifying and diagnosing problems. One of its main drawbacks, however, is its cost.

g. Brumburgh has found the newsletters to be an effective vehicle for conveying information to the public. Along with Flanigan, he urged us to utilize the Md. CZM newsletter (Coast and Bay Bylines) to disseminate information about the Chesapeake Bay Study.

h. Brumburgh indicated a need for related Study programs to use, whereever possible, mutual public involvement elements, such as newsletters, or advisory groups such as CRAC. He felt that the general public would be far more receptive to programs if duplication of efforts was avoided and where obvious coordination was attempted. He stated that much effort has been made during the last two years to develop mechanisms whereby fewer numbers of groups would be responsible for providing public input into water resources planning efforts, particularly as they relate to the coastal zone. He felt it would be in our best interests to utilize these mechanisms wherever and whenever possible during the conduct of our public involvement program.

i. Brumburgh cautioned that because there are many related studies being conducted on Chesapeake Bay and its resources, it is extremely important that the public be made aware of what the objectives of our study are and how they are different from those of other related studies.

5. Both meetings appeared to be quite fruitful in helping to formulate the public involvement program for the final study phase, and specifically, in furthering our knowledge of who the interested public is and how they find out about what is taking place with regard to the Bay and its resources.

NABPL-C
5 June 1978

SUBJECT: Meeting with the Maryland Coordinator for the Citizens Program for Chesapeake Bay's Public Involvement Program and the Coordinator for the Maryland Coastal Zone Management's Public and Local Government Participation Program

It was concluded at each meeting that continued coordination between the undersigned and both Flanigan and Brumburgh was important to a successful public involvement program.

Rausch

RAUSCH

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NABPL-C
26 June 1978

SUBJECT: Meeting with the Executive Director, Citizens Program for Chesapeake Bay, Public Participation Program; the Public Involvement Specialist for the Virginia Coastal Resources Management Program; and the Public Involvement Specialist for the Virginia State Water Control Board's 208 Program.

MEMORANDUM TO THE FILE

1. On 20-21 June 1978, the undersigned traveled to Richmond, Virginia, to meet with several individuals directing public involvement programs associated with various water resources planning efforts. At a joint meeting held on 20 June in the Virginia Office of Commerce and Resources, the undersigned met with Mr. George Hagerman, Executive Director of the Citizens Program for Chesapeake Bay's Public Participation Program and Ms. Kitty Cox, Public Involvement Specialist for the Virginia Coastal Resources Management Program (this program is being directed within the Office of Commerce and Resources). On 21 June, the undersigned met with Ms. Vicki Maddox, Public Involvement Specialist for the Virginia 208 Program being directed by the Virginia State Water Control Board.

2. There were three major objectives to be reached at each meeting. These included:

a. To further determine who the interested and affected public is with regard to related water resources studies in the region.

b. To determine what means and mechanisms have been used effectively in other public participation programs to involve the public.

c. To determine the best means available to coordinate the Chesapeake Bay Study Public Involvement Program with other related programs.

3. During the meeting with Hagerman and Cox, the following major points and comments were raised:

a. Hagerman invited the undersigned or someone from the Baltimore District to attend the business meeting of the Citizens Steering Committee of the EPA Chesapeake Bay Program to be held in St. Michaels, Maryland on 18 July 78. The purpose of attending would be to first inform the committee of the Chesapeake Bay Study objectives, outputs to date, and final study phase, and second, initiate discussion on effective means of public involvement and coordination of the two Chesapeake Bay studies (particularly with regard to public participation).

b. Hagerman, while under contract with the Virginia Coastal Resources Management (CRM) Program assisted Cox in sponsoring a large 2-day workshop in Hampton, Virginia. The purpose of the workshop was to solicit

from the public specific recommendations for the management of Virginia's coastal land and water resources. A copy of the workshop program is included as Inclosure 1. Hagerman stressed the need for strong, knowledgeable workshop leaders who are capable of keeping the workshop on track toward achieving its goals and of assuring that no one person dominates group discussions. For a large workshop to be successful, (up to 3 months) extensive preparation is required. In addition, coordination and assistance from local citizens groups is extremely helpful in setting up and running the workshop. It is also important to invite key persons to the workshop although an announcement is normally sent to the entire mailing list (thus, no one feels overlooked). Finally, attendance at workshops is probably best if the workshop is held at night. c. Hagerman indicated that there are two important aspects to a successful public involvement program. First, the level of public awareness with regard to the study must be raised. It must be shown that the study is going to impact on the public, personally. Second, the public must be educated with regard to the study. Newsletters and fact sheets are effective means of achieving both of these.

d. Hagerman is currently working on several public involvement activities for the EPA Study. A film is being produced concerning the EPA Chesapeake Bay Study. In the film, Senator Mathias will make several statements in support of the Study. The film will feature a sailboat race down the Bay, and shots of the Maritime Heritage Festival recently held in Baltimore. The film will be shown on CBS during prime time before the end of July. In October, Hagerman is planning to send out questionnaires as a supplement to a large number of weekly newspapers. This will be closely followed by a T.V. program on PBS stations to discuss the EPA program and related impacts, and problems which the program will address. The public will be asked to respond to the questionnaire and mail to Hagerman's office. He stressed that it is important to both consider the public's views as well as let the public know that you are considering their views.

e. Hagerman would like to incorporate in one newsletter information on as many Chesapeake Bay related studies as possible. He has gotten Don Budlong, director of the Virginia CRM Program, to agree to purchase one page of the CPCB Newsletter (Chesapeake Citizen) for discussion of Virginia's CRM program (The CRM program does not have a newsletter of its own). Cost will be $100/page. Hagerman is naturally very receptive to our contributing articles to the CPCB newsletter.

f. Hagerman has put together a list of about 1,000 organizations who have an interest in Chesapeake Bay. Questionnaires have been mailed to these organizations on a regional basis. Response to the questionnaires has been varied, with some regions (tidewater Virginia) having

as much as a 30% response. He will have each regional office of the public participation program send a list of those organizations and indicate which have responded to the questionnaire. It can probably be assumed that those groups responding have the most interest in the Bay. This will be useful information to us.

g. During FY 79, CPCB, as part of its Public Participation Program, is planning to take part in 96 public presentations. These presentations will be given to environmental, civic, and other interested groups. Hagerman welcomed us to participate in some of these presentations in order to better inform the public of our Study and to stimulate public discussion on various aspects of the Study. The Regional Offices are to put together an agenda listing those presentations scheduled for their region. Hagerman will see that we receive these agendas if we desire. The undersigned indicated interest in this project.

h. Both Hagerman and Cox indicated that many of those more "aware" members of the Virginia public are not familiar at all with the Corps Chesapeake Bay Study and considerably more effort on our part is required to rectify this situation.

i. Virginia, as part of its CRM Program, has sponsored one large workshop (discussed earlier) as well as a number of public workshops sponsored by the planning district commissions within the coastal zone of Virginia. The large workshop, according to Cox, was the most productive of the workshops, although the small workshops were also helpful (particularly in establishing good working relationships with community groups). The CRM program has also had considerable local television and PBS coverage (particularly in the Hampton Roads area) which was effective in making the public aware of the program and in obtaining information on public concerns with regard to coastal resources. Virginia also sponsored a "coastal awareness celebration" in the fall of 1977 (prior to a series of public hearings on the CRM program). Groups and organizations were asked to sponsor activities to help make the public more aware of the coastal resources. For example, boat rides on the Bay were sponsored by certain groups as were walks into the Dismal Swamp. Exhibits were put together for display at various festivals and other "awareness" techniques were employed at fairs and carnivals. This "awareness celebration" was generally successful although it was organized too late to be as effective as it could have been.

j. The following groups and organizations in Virginia were identified by Hagerman and Cox as being particularly useful in assisting with and interested in water resources planning:

Izaak Walton League
League of Women Voters

Junior League
State Chamber of Commerce
County Farm Bureaus
Soil Conservation Districts
Citizens Program for Chesapeake Bay
Chesapeake Bay Foundation, York Chapter
Virginia Seafood Council
Virginia Petroleum Industries

4. During the meeting with Maddox, the following major points and comments were raised:

a. The State Water Control Board (SWCB) has just issued its first newsletter entitled Waterlogue. The bimonthly publication contains extensive information on the Virginia 208 Program (included here as Inclosure 2). The publication has some good ideas in terms of format and may be useful to us in preparation of our News Circular. Much of the distribution of the 208 newsletter will be in large quantities to regional and statewide organizations who have, in turn, agreed to further distribute to their membership. We have been placed on the mailing list to receive Waterlogue.

b. SWCB is planning a "media blitz" for rural areas in order to inform the public of the 208 Program. The blitz will include radio and TV announcements concerning points of interest about the 208 Program, public broadcasting station programs featuring an EPA video tape on the 208 Program, and a series of public hearings in order to answer questions and hear public testimony regarding the 208 Program.

c. SWCB is also planning to distribute Best Management Practices Handbooks to interested individuals. These handbooks will present information on the most effective, practicable means of presenting or reducing the amount of pollution generated by non-point sources to a level compatible with water quality goals. The handbooks will be an important part of the 208 program effort to educate the public.

d. A Statewide Policy Advisory Committee is presently being established and will be composed of private citizens, and local elected officials. Seven Areawide Policy Advisory Committees have already been established and have proved effective in providing public input into the 208 Program.

5. As with the series of meetings held in Annapolis on 1 June 1978, to discuss public involvement efforts in Maryland, these meetings appeared fruitful in two respects. First, in helping us formulate the public involvement program for the final study phase and second, in providing important insight on our program to those individuals involved, first hand,

in public participation. The undersigned believes that these series of meetings in themselves have been quite useful in furthering public knowledge of the Chesapeake Bay Study and that a good working relationship has been established with these valuable resource people.

Rausch
RAUSCH

NABPL-C

6 Jul [illegible]

Dr. Robert Lippson
National Marine Fisheries Service
Lab for Ecology and Pathology of
Marine Organisms
Oxford, Maryland 21654

Dear Dr. Lippson:

The Hydraulic Model of Chesapeake Bay is now entering its second year of testing. To date, the model has been used primarily to develop hydrodynamic data for use in determining the effects of deepening the Baltimore Harbor and approach channels from 42 to 50 feet and the effects of using the Potomac Estuary as a supplemental source of water supply for the Washington, D.C. Metropolitan area. Other testing related to the C & D Canal and oil spills in the Norfolk, Virginia area has also been conducted.

As you will note on the inclosed schedule, a full program of testing is scheduled through the end of Fiscal Year 1981, which marks the close of the presently authorized testing program. The testing presently scheduled is in support of both the Corps Chesapeake Bay Study and the studies of several Federal and State agencies. Generally, work to be done under the auspices of the Chesapeake Bay Study will be limited to Bay-wide tests with widespread benefits. Funding for studies related to localized/specific problems or problems whose solutions will be implemented by other agencies will be the responsibility of the agency requesting the study.

In addition to providing the above status report on the model testing program, the purpose of this letter is also to request a listing of any future model studies desired by your agency. While a seemingly full program of testing is scheduled through the end of Fiscal Year 1981, there may be ample opportunity to conduct any desired testing either concurrent with the present program or to reorder the testing priorities. Further, in order to develop a longer range plan for the disposition of the hydraulic model, any testing desired beyond Fiscal Year 1981 should also be identified. In this same regard, I would also appreciate your views and/or recommendations relative to other needs for the hydraulic model beyond the present program.

I recognize that your needs for the hydraulic model and the funding to support it cannot be predicted with a high degree of certainty; however, I cannot emphasize strongly enough the importance of your input as it relates to the future use and availability of the Hydraulic Model of Chesapeake Bay.

Sincerely,

ALFRED E. ROBINSON, Jr.
Chairman
Chesapeake Bay Study Steering Committee

1 Incl
As stated

IDENTICAL LETTER SENT TO:

Dr. Glenn Kinser
Supervisor, Annapolis Field Office
Division of River Basin Studies
U.S. Fish and Wildlife Service
1825 B Virginia Street
Annapolis, Maryland 21401

Mr. Albert E. Sanderson, Jr.
Water Resources Administration
Tawes State Office Building
Annapolis, Maryland 21401

Mr. L. E. Zeni
Administrator
Tidewater Administration
Department of Natural Resources
Tawes State Office Building
Annapolis, Maryland 21401

Dr. L. Eugene Cronin
Chesapeake Research Consortium, Inc.
1419 Forest Drive
Suite 207
Annapolis, Maryland 21403

Dr. M. Grant Gross
Director
Chesapeake Bay Institute
The Johns Hopkins University
Baltimore, Maryland 21218

Dr. Donald W. Pritchard
Marine Science Research Center
Building G, South Campus
State University of New York
at Stonybrook
Stonybrook, New York 11794

Mr. William N. Frazier
Chief, Water Resources Branch
Bureau of Resources Programming
Department of Environmental Resources
P.O. Box 1467
Harrisburg, Pennsylvania 17102

CORPS OF ENGINEERS

CHESAPEAKE BAY STUDY

CHESAPEAKE BAY HYDRAULIC MODEL TESTING SCHEDULE

FISCAL YEAR 1979

Baltimore Harbor Test
C & D Canal Test
Potomac Estuary Test
Hampton Roads Oil Spill Test
Low Freshwater Inflow Test

FISCAL YEAR 1980

Maryland Power Plant Test
Complete Potomac Estuary Test
Complete Low Freshwater Inflow Test
Storm Surge Test

FISCAL YEAR 1981

High Freshwater Inflow Test
EPA Bay-wide Wastewater Dispersion Test
Low Freshwater Inflow Plan Test
Wastewater Dispersion Test (Old Dominion University)

NABPL-C

JUL

Dr. Robert L. Lippson
Research Coordinator, Environmental
  Assessment Branch
Laboratory for Ecology and
  Pathology of Marine Organisms
Oxford, Maryland 21654

Dear Dr. Lippson:

Inclosed for your review is a copy of the Summary of Remarks from the Chesapeake Bay Study Steering Committee meeting held on 8 June 1978. Any comments you may have concerning the Revised Plan of Study, the hydraulic model testing to be conducted in the final phase of the program, or the Summary of Remarks, should be provided as soon as practicable. Should you have any questions concerning this matter, please do not hesitate to call me at (301) 962-2512.

Sincerely yours,

1 Incl
As stated

ALFRED E. ROBINSON, Jr.
Chairman, Chesapeake Bay
Study Steering Committee

NABPL-C

13 July 1978

SUBJECT: Meeting with staff members from the Maryland CZM, Citizens Program for the Chesapeake Bay, Incorporated, and the Delmarva Advisory Council to discuss a cooperative Chesapeake Bay Display

MEMORANDUM TO THE FILE

1. On 11 July 1978, the undersigned met with Mr. Scott Brumburgh of the Maryland Coastal Zone Unit, Ms. Frances Flanigan of the Citizens Program for the Chesapeake Bay, Inc., and Messrs Harry Stone and John Haffner of the Delmarva Advisory Council. The purpose of the meeting was to discuss the possibility of developing a mutual Chesapeake Bay display for use in libraries throughout the Maryland portion of the Chesapeake Bay Region.

2. One of the main objectives of the display would be to demonstrate that a number of State and Federal agencies are working cooperatively toward improving Chesapeake Bay. The Maryland CZM unit and the CPCB agreed to provide funding for the display. Each organization represented at the meeting will provide graphics and/or photos demonstrating how that agency is working to better the Bay. A specific theme will be decided on later.

3. Detail concerning the display's physical characteristics, where it would be placed, and what might be included on it were discussed at the meeting. The important points discussed include:

a. The display would be placed in a library for about a month and then moved to another location. It was agreed that the main branch of an Eastern Shore County library would be the best place to initiate the display. Several libraries will be contacted to determine their interest in and facilities for such a display.

b. Three types of displays are being considered: a free standing (self-supporting) type, a table-top type, and a window display. Cost, overall effectiveness, and library preferences will be considered in determining which of the three will be best. Requirements for the display are that it be portable for easy transport by one person, that it be professional looking, that it have some kind of self illumination, and that it be a static exhibit - free of moving (and expensive) parts.

c. Handouts will accompany the display so that if the public is interested, they can find out more about a particular study. The possibility of including a return mailer on each piece of literature was discussed. The cost of "mail-backs" may be a hindrance to this practice, however.

NABPL-C 13 July 1978

SUBJECT: Meeting with staff members from the Maryland CZM, Citizens Program for the Chesapeake Bay, Incorporated, and the Delmarva Advisory Council to discuss a cooperative Chesapeake Bay Display

d. The major programs which will be shown in the display include the Maryland Coastal Zone Management Program, the Corps' Chesapeake Bay Study, and the Environmental Protection Agency's Chesapeake Bay Program. Depiction of other Federal and State agency programs and activities will be considered for inclusion, however.

e. It was agreed that the display may be more effective if its initial use coincides with the Chesapeake Bay Appreciation Weekend at the end of October. This would also give the participating groups enough time to create the display. The display will be used only in libraries, initially; later (depending on its success) it may be placed in other public areas including the Maryland Academy of Sciences,banks, convention centers, and at related conferences.

f. It was agreed that in order to achieve a professional looking display, it would be best to talk with a contractor concerning format, type of materials to be included on the display (graphics or photos), the various types of displays available and the costs associated with each. If the cost is not prohibitive, a contractor may be retained to do the design and construction of the display. Brumburgh will have lead responsibility in contacting consultants since the Maryland CZM will be providing most of the funding for the display.

4. A meeting is planned for August to discuss what Brumburgh has found out with regard to display costs and formats.

5. It is suggested by the undersigned that the PAO be kept informed of the status of this project and may even wish to attend a future coordination meeting.

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CRC

20 March 1979

Dr. George E. Dieter, Dean
College of Engineering
University of Maryland
College Park, Maryland 20742

Dear Dr. Dieter:

The Baltimore District of the U.S. Army Corps of Engineers is operating a unique hydraulic model of the Chesapeake Bay at Matapeake, on Kent Island near the Chesapeake Bay Bridge above Annapolis. The model was completed in 1976, verification tests were conducted until May of 1978, and a series of projects has now been completed.

The Baltimore District and the Chesapeake Research Consortium invite you or an interested associate to visit the Model for an informal Seminar on June 27, 1979. The Model is the largest estuarine hydraulic model in the world and is of exceptional interest as an engineering accomplishment and tool. We believe that scientists and engineers of the region might wish to see the Model, hear a series of presentations on the design and conduct of the massive prototype studies, construction of the Model, verification against the prototype, and the conduct of experiments. Tests have been run or are in progress on (1) the effects of completing a 50-foot channel from Baltimore to the Capes in Virginia, (2) the feasibility of using the Potomac estuary as a source of water for the Washington metropolitan area, (3) the distribution of heated effluents from power plants and (4) effects of reduction of fresh water inflow into the Bay system. This should provide an excellent opportunity to review the capabilities and limitations of this model and to consider any use it may have in the education of undergraduate or graduate students or in your research programs. A test will be in progress on the day of the Seminar.

Principally, however, we invite you to spend a day with interested associates learning more about an exceptional regional facility. A tentative agendum for the Seminar is enclosed.

Chesapeake Research Consortium, Incorporated

1419 Forest Drive, Suite 207
Annapolis, Maryland 21403
(301) 263-0884

The Johns Hopkins University
University of Maryland
Smithsonian Institution
Virginia Institute of Marine Science

We are limiting participation to 30, so that we would especially appreciate early information on the name of you or your associates who wish to participate. The visit will begin at 9 a.m., a dutch treat box luncheon will be provided, and we should be finished by 4 p.m.

We look forward to the Seminar. If convenient, please respond by 15 April.

Cordially,

L. Eugene Cronin
For the Baltimore District
and the
Chesapeake Research Consortium

LEC/dmr
Enclosure

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT CORPS OF ENGINEERS
P O BOX 1715
BALTIMORE MARYLAND 21203

REPLY TO ATTENTION OF:
NABPA

16 April 1979

SUBJECT: Potomac River Estuary Water Supply and Wastewater Dispersion Test

TO: Members of the News Media

The inclosed News Release (Inclosure 1) announces the initiation of the Potomac River Estuary Water Supply and Wastewater Dispersion Test on the Corps' Chesapeake Bay Hydraulic Model. A press briefing will be held on 25 April 1979 at 1000 hours at the Chesapeake Bay Hydraulic Model facility located at Matapeake, Maryland. Included as Inclosure 2 is a map to the model site. The purpose of the briefing is to allow members of the press to tour the hydraulic model and to observe the Potomac test firsthand. The press will be allowed tp photograph the hydraulic model and its appurtenances.

It is requested that the Baltimore District Public Affairs Office be contacted at (301) 962-4616 if a representative from your office plans to attend the press briefing.

FOR THE DISTRICT ENGINEER:

M. R. Stevens

2 Incl
As

M. R. STEVENS
Chief, Public Affairs Office

United States Army
Corps of Engineers
...Serving the Army
...Serving the Nation
Baltimore District

NEWS RELEASE

United States Army Corps Of Engineers • Baltimore District • P.O. Box 1715 • Baltimore, MD 21203 • Public Affairs Office • Tel. (301) 962-4616

FOR IMMEDIATE RELEASE PA79-44

The Baltimore District Corps of Engineers is currently conducting tests on its Chesapeake Bay Hydraulic Model located at Matapeake, Maryland, to explore the effects of using the Potomac River Estuary as a supplemental source of water supply for the Metropolitan Washington, D.C. Area. This test is being conducted in conjunction with the Corps' Metropolitan Washington Area Water Supply Study.

The Hydraulic Model of Chesapeake Bay is a scientific tool used by the engineer, scientist, and water resource planner to analyze hydraulic problems that cannot be resolved from test books, experience, or mathematical treatment alone. The hydraulic model can reproduce to a manageable scale phenomena that occur throughout this large and complex estuarine system. The model encompasses the entire Chesapeake Bay and tributaries to the head of tide and the surrounding land area to an elevation of 20 feet above mean sea level. A brochure describing the Bay model and its characteristics is attached.

For the Potomac River Estuary Water Supply and Wastewater Dispersion Test, the model will be used to define the salinities and wastewater dispersion patterns in the estuary under varying Potomac freshwater inflows and to determine the impact of withdrawing water from the upper Potomac Estuary at Washington, D.C. Once the impacts associated with varying freshwater inflows and withdrawing water from the Estuary are known, it will be possible to determine effects on man and his environment including impacts [illegible] River fisheries and water contact sports in the Potomac.

[illegible] testing will be conducted in two phases. The first phase will [illegible] of various freshwater inflows under present or existing

M O R E

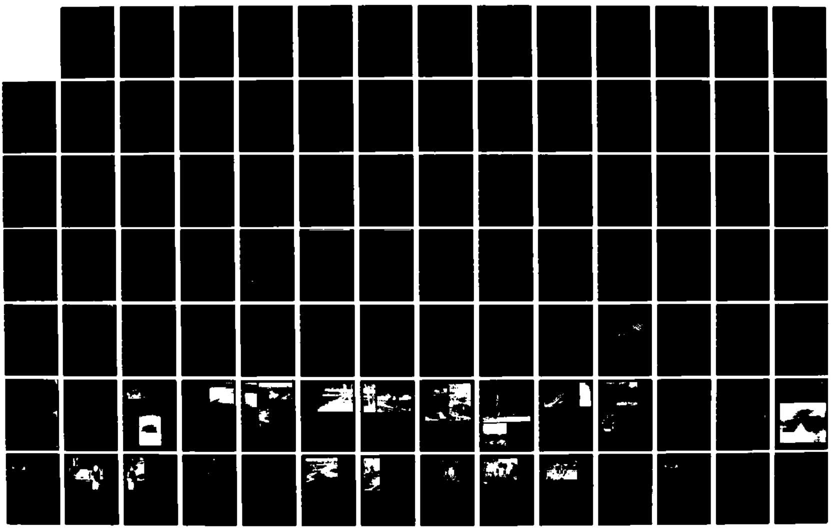
1st add Potomac River PA79-44

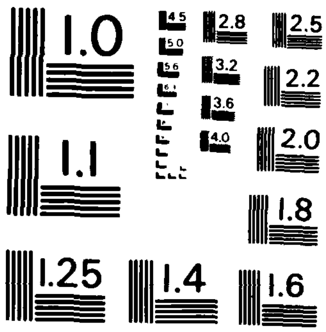
conditions, while the second phase will define impacts of freshwater inflows under conditions at a future date. Model testing is expected to be concluded by October.

- 30 -

AD-A161 475 CHESAPEAKE BAY STUDY SUPPLEMENT A PROBLEM IDENTIFICATION SUPPLEMENT B PUB..(U) CORPS OF ENGINEERS BALTIMORE MD BALTIMORE DISTRICT SEP 84 4/5

UNCLASSIFIED CHB-84-S-SUPPL-A-B-C F/G 8/6 NL

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NABPL-C

W

Honorable James B. Coulter
Secretary
Department of Natural Resources
Annapolis, Maryland 21401

Dear Mr. Coulter:

The Hydraulic Model of Chesapeake Bay is now entering its second year of testing. To date, the model has been used primarily to develop hydrodynamic data for use in determining the effects of deepening the Baltimore Harbor and approach channels from 42 to 50 feet and the effects of using the Potomac Estuary as a supplemental source of water supply for the Washington, D.C. Metropolitan area. Other testing related to the C & D Canal and oil spills in the Norfolk, Virginia area has also been conducted.

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In addition to providing the above status report on the model testing program, the purpose of this letter is also to request a listing of any future model studies desired by your agency. While a seemingly full program of testing is scheduled through the end of Fiscal Year 1981, there may be ample opportunity to conduct any desired testing either concurrent with the present program or to reorder the testing priorities. Further, in order to develop a longer range plan for the disposition of the hydraulic model, any testing desired beyond Fiscal Year 1981 should also be identified. In this same regard, I would also appreciate your views and/or recommendations relative to other needs for the hydraulic model beyond the present program.

NABPL-C
Honorable James B. Coulter

I recognize that your needs for the hydraulic model and the funding to support it cannot be predicted with a high degree of certainty; however, I cannot emphasize strongly enough the importance of your input as it relates to the future use and availability of the Hydraulic Model of Chesapeake Bay.

Sincerely,

G. K. WITHERS
Colonel, Corps of Engineers
District Engineer

1 Incl
As stated

RAUSCH/ere/23410/NABPL-C
BEDGLE/NABPL-C
ROBINSON/NABPL-C
NELSON/NABPL
FRIESCHMAN/NABPL
~~SEITZ/NABEX~~
BHEN/NABDD
WITHERS/NABDE

W 26 Jun 7

IDENTICAL LETTER SENT TO:

r. Gerald R. Calhoun
ate Conservationist, Maryland
oom 522, Hartwick Building
321 Hartwick Road
ollege Park, Maryland 20740

r. Henry L. DeGraff
ssistant Chief
egional Economic Analysis Division
ureau of Economic Analysis
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oom 309 (BE-61)
ashington, D.C. 20230

r. Austin P. Olney
ecretary
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and Environmental Control
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r. Herbert L. Tucker
irector
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r. D. Heyward Hamilton
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ashington, D.C. 20545

r. James D. Hebson
egional Engineer
ederal Energy Regulatory Commission
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3 Federal Plaza
ew York, New York 10007

r. Tudor Davies
irector, Chesapeake Bay Program
nvironmental Protection Agency
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rownsville, Maryland 21032

Mr. Lawrence Levine
Environmental Officer
Department of Housing and
Urban Development
Curtis Building
Philadelphia, Pennsylvania 19106

Mr. William Patterson
Regional Environmental Officer
Northeast Region
Department of the Interior
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Boston, Massachusetts 02109

Dr. Edward H. Bryan
Program Manager
Directorate for Engineering and
Applied Science
National Science Foundation
Room 1128
1800 G Street, N.W.
Washington, D.C. 20550

Mr. Edward W. Johnson
Environmental Protection Division, OP-45
Office of the Chief of Naval Operations
BD 766, Pentagon
Washington, D.C. 20350

Mr. Clifford H. McConnell
Deputy Secretary
Resources Management
Department of Environmental Resources
P.O. Box 1467
Harrisburg, Pennsylvania 17120

Dr. J. Kevin Sullivan
Director, Chesapeake Bay Center
for Environmental Studies
Smithsonian Institution
P.O. Box 28
Edgewater, Maryland 21037

Captain J. W. Kime, USCG
Captain of the Port
Customs House
Baltimore, Maryland 21202

Dr. William J. Hargis, Jr.
Director
Virginia Institute of Marine Science
Gloucester Point, Virginia 23062

Mr. Paul W. Eastman
Executive Director
Interstate Commission on the Potomac
River Basin
1055 First Street
Rockville, Maryland 20850

Dr. Maurice K. Goddard
Chairman
Susquehanna River Basin Commission
Department of Environmental Resources
P.O. Box 1467
Harrisburg, Pennsylvania 17105

Mr. Robert N. Davis
Executive Director
State Water Control Board
P.O. Box 11143
Richmond, Virginia 23230

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 1715
BALTIMORE, MARYLAND 21203

REPLY TO ATTENTION OF
NABPL-C

6 August 1979

SUBJECT: The Low Freshwater Inflow Hydraulic Model Test

TO: Interested Federal and State Agencies, Institutions, Groups, and Individuals

In August 1979, the Baltimore District, Corps of Engineers, as part of its Chesapeake Bay Study, will begin conducting a Low Freshwater Inflow Test on its Chesapeake Bay Hydraulic Model located at Matapeake, Maryland. The test constitutes an important part of the Low Freshwater Inflow Study. The Low Flow Study has three basic objectives which are:

1. To provide a better understanding of the relationship between Chesapeake Bay salinities and the freshwater inflow from its tributaries.

2. To define the environmental and socio-economic impacts of both short and long term reductions of freshwater inflows.

3. To recommend those minimum flows that should be provided by the major tributaries to maintain the integrity of the Bay.

The model will be used to define the salinity inflow relationships occurring under a variety of low freshwater inflow conditions and to determine the influence of each of the major tributaries on Bay salinities.

Based on the testing results, biological, economic, and social impact assessments will be conducted to determine the effects of changes in salinity and to define both existing and potential problems related to freshwater inflow reductions. Alternative flows to alleviate the identified problems will then be formulated and evaluated. The model will again be used for a Low Flow Plan Test, to be run in 1981, in order to help select final recommended flows.

For more information on the Low Freshwater Inflow Study and related model testing, it is suggested that Mr. Alfred E. Robinson, Jr., Chief of the Chesapeake Bay Study Branch be called at (301) 962-2512.

Sincerely yours,

WILLIAM E. TRIESCHMAN, Jr.
Chief, Planning Division

CRC

26 September 1979

Dr. Frank Fang
Virginia Institute of Marine Science
Gloucester Point, Virginia 23062

Dear Frank:

The Chesapeake Bay Hydraulic Model Seminar, co-sponsored by the Baltimore District of the U.S. Army Corps of Engineers and the Chesapeake Research Consortium, has been rescheduled for 14 November 1979. The new Visitor's Center at the Model will be available and comfortable at that time. The principal purpose is to inform academic institutions of the region of the nature of the Model and to explore its potentials in research and teaching.

Since our original contact was with Dr. Hargis, we are sending him a copy of this invitation. Either or both of you would be welcome.

Please respond at your earliest convenience. We must know by November 1st, at the latest, who will be attending. A dutch treat box lunch will cost approximately $4.00.

The tentative agendum and a map of the area are enclosed. Please let us know if you have questions or suggestions. We hope that you can participate.

Cordially,

L. Eugene Cronin
For the Baltimore District
and the
Chesapeake Research Consortium

LEC/dmr
Enclosures

cc: Dr. Hargis

Chesapeake Research Consortium, Incorporated
1419 Forest Drive, Suite 207
Annapolis, Maryland 21403
(301) 263-0384
The Johns Hopkins University
University of Maryland
Smithsonian Institution
Virginia Institute of Marine Science

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT CORPS OF ENGINEERS
P O BOX 1715
BALTIMORE MARYLAND 21203

REPLY TO ATTENTION OF
NABPA

7 November 1979

SUBJECT: Visit of NATO Committee on the Challenges of Modern Society to the Chesapeake Bay Hydraulic Model, Matapeake, Maryland, After Action Report

THRU: Division Engineer, North Atlantic
ATTN: NADPA

TO: HQDA
ATTN: DAEN-PA
Washington, D.C. 20015

1. On 25 October 1979, members of the NATO Committee on the Challenges of Modern Society visited the Chesapeake Bay Hydraulic Model.

2. Prior communications between Mr. Jeff Gallup of the State Department and the Baltimore District Public Affairs Officer indicated that approximately 50 members of the Committee (many of Ministerial rank) would attend.

3. Due to changes of plans for some of the Committee members only 22 people were on hand for a tour and briefing. (A list of the attendees is attached.)

4. Colonel James W. Peck, District Engineer, conducted the briefing and answered questions. Members of the Chesapeake Bay Study Group and the Public Affairs Office were on hand to assist Colonel Peck.

5. Packets of information on the Chesapeake Bay Model, the Corps of Engineers, and the Baltimore District were provided to each member attending.

6. After a tour of the Model the group departed for the U.S. Naval Academy.

7. Colonel Robert L. Friedenwald, OCE, Assistant Director for Atlantic Division, was present as an observer.

CF: NABPL-C
NABAS-S

8. According to Mr. Gallup of the State Department, the visitors were quite impressed with the Chesapeake Bay Model and the briefing they received. He further indicated that the Model would be considered for future tours of this type.

FOR THE DISTRICT ENGINEER:

M R Stevens
M.R. STEVENS
Chief, Public Affairs Office

1 Incl
as

LIST OF NATO COMMITTEE, CHALLENGES OF MODERN SOCIETY, ATTENDING TOUR

United States:

Ambassador W. Tapley Bennett, Jr., and Mrs. Bennett
Permanent Representative to the North Atlantic Treaty Organization

Mr. Jeffrey C. Gallup
EUR/RPM - CCMS Officer

Mr. Harry Blaney
Economic Advisor - USNATO

Mr. Michael Sake
USICA

Miss Edwina Campbell
Consultant - EPA

Ms. Mitzi Shitanda
Office of U.S. Coordinator - EPA

Canada:

Carol Martin
International Programs Branch
Department of the Environment
Ottawa

Denmark:

Mr. Jorgen Hartnack
Delegate

Germany, Federal Republic of

Dr. Juergen Pankrath
Federal Environmental Office
Berlin

Greece:

Dr. Thomas Dimitriades
Head of Geothermal Department
Public Power Corporation
Athens

Italy:

V. Schiavone
Delegate

Luxembourg:

Colonel Albert Lucas
Office of National Security
Luxembourg

Norway:

Kjell Glomnes
Chief Engineer
Ministry of Environment
Oslo

Liv Eckhoff
Head of Section
Ministry of Environment
Oslo

United Kingdom:

W. McIndoe, Head of Delegation
Deputy Secretary
Department of Environment
London

J. M. Hope
Assistant Secretary
Department of Environment
London

Peter D. Burgess
Department of Environment
London

International Staff:

Mr. Paul Van Campen (Netherlands)
Director, Secretary General's office

Miss Elizabeth Borgman Brouwer (Netherlands)
Personal Assistant to Secretary General

Dr. Phillip Hemily (U.S.)
Acting Asst. Secretary General for Scientific & Environmental Affairs

Mr. Moran (Britain)
Secretary for CCMS (Office Director)

Educational Seminar
Chesapeake Bay Hydraulic Model
14 November 1979

Co-Sponsored by Corps of Engineers and Chesapeake Research Consortium, Inc.

0900 Welcome - Opening Remarks (Col. Peck, District Engineer, Baltimore District and Dr. Peter Wagner, Chesapeake Research Consortium)

0915 Chesapeake Bay Study Program (Mr. Ted Robinson, Baltimore District)

0930 Overview of Hydraulic Modeling (Mr. Henry Simmons, Waterways Experiment Station)

0950 Prototype Data Collection Program (Dr. Robert Ulanowicz, Chesapeake Biological Lab)

1010 Chesapeake Bay Model (Mr. Richard Sager, Waterways Experiment Station)

1045 Model Operation (Mr. Dave Bastian, Waterways Experiment Station)

1115 Model Tour (Dr. James McKay, Baltimore District) and Salinity Stratification Demonstration (Mr. David Bastian, Waterways Experiment Station)

1230 Buffet Lunch

1330 Use and/or Application of Hydraulic Model Data (Dr. William Hargis, Virginia Institute of Marine Science and Mr. Noel Beegle, Baltimore District)

1430 Complementary Use of Numerical Models (Dr. Donald Pritchard, State University of New York at Stony Brook)

1500 Use of the Hydraulic Model by Others (Mr. Ted Robinson, Baltimore District)

1515 Summary - Closing Remarks (Dr. Eugene Cronin, Chesapeake Research Consortium)

1530 Adjournment (Mr. Ted Robinson, Baltimore District)

JAMES B. COULTER
SECRETARY

STATE OF MARYLAND
DEPARTMENT OF NATURAL RESOURCES
TIDEWATER ADMINISTRATION
TAWES STATE OFFICE BUILDING
ANNAPOLIS 21401
Area (301) 269-2784

LOUIS N. PHIPPS, JR.
DEPUTY SECRETARY

February 7, 1980

Colonel James W. Peck
District Engineer
Baltimore District
U.S. Army Corps of Engineers
P.O. Box 1715
Baltimore, Maryland 21203

Dear Colonel Peck:

This is to inform you of the status of the joint resolution requesting the Congress to appropriate the necessary funds for the continued operation of the Chesapeake Bay Hydraulic Model at Matapeake, Maryland after Fiscal Year 1981 (See enclosed Resolution). As you will note, several steps have been taken.

First, the State of Maryland has been able to find a sponsor to introduce the Resolution during this session. Second, the Commonwealth of Virginia has agreed, through Secretary Rowe's office, to introduce the Resolution at its current session. Third, Dr. Eugene Cronin has stated that he will seek supplemental support of the Resolution by the Chesapeake Bay Legislative Advisory Committee.

Toward the end of this month, the sub-committee from the Bi-State Working Committee, which helped to draft the Joint Resolution, will meet in order to begin to develop the support data needed to substantiate the continuation of the Model's operation.

I will keep you informed about the progress of the Resolution as soon as I hear of anything definite.

Sincerely,

Sarah

Dr. Sarah J. Taylor
Director, Coastal Resources Division

SJT/cjg

cc: Mr. Alfred E. Robinson, Jr., Chesapeake Bay Study Branch Chief

Mr. Noel E. Beegle, Study Coordination and Evaluation Section

A JOINT RESOLUTION to Request the Congress of the United States to Appropriate the Necessary Funds for the Continued Operation of the United States Army Corps of Engineers Chesapeake Bay Hydraulic Model at Matapeake Maryland After Fiscal Year 1981.

WHEREAS, the hydraulic model was constructed as part of the comprehensive study for the Chesapeake Bay, which was authorized by Congress in Section 312 of the Rivers and Harbors Act of 1965; and

WHEREAS, continued funding for the hydraulic model will be terminated after Fiscal Year 1981; and

WHEREAS, it has only been since Fiscal Year 1979 that studies have begun to be undertaken using the model's capabilities in the areas of harbor, canal, estuary, low flow, high flow, wastewater and dispersion tests; and

WHEREAS, the research problems that are capable of being handled are more extensive than the tests being addressed to the end of Fiscal Year 1981; and

WHEREAS, the Chesapeake Bay Hydraulic Model is a scientific tool capable of being used in the future by the engineers, scientists, and water resources planners from different levels of government and from different academic institutions to analyze hydraulic problems that cannot be resolved from text books, experience, or the recently emergent numerical modeling field; and

WHEREAS, the model as an instrument and physical display is unexcelled in its potential for the education of an interested public in the scope and magnitude of the problems and conflicts that affect this valuable resource both now and in the future; and

WHEREAS, the model as an operational focal point promotes more effective liaison among the many agencies working in the Chesapeake Bay waters and helps to reduce duplication of research effort; and

WHEREAS, by applying the knowledge gained from the Chesapeake Bay Study and the hydraulic model, plans can be formulated that will insure a balanced approach to developing the Chesapeake Bay's numerous but limited resources while protecting her natural beauty; and

WHEREAS, the model is in place and operational after the expenditure of significant resources involved in its design, construction, adjustment and verification, and is a readily available tool to analyze phenomena of the Nation's largest estuary;

BE IT RESOLVED BY THE STATE OF MARYLAND AND THE COMMONWEALTH OF VIRGINIA, that the model be kept operational beyond Fiscal Year 1981 and that funds necessary to keep the model operational be appropriated by the Congress of the United States, with required resources and model uses determined and recommended to the Congress by a committee of representatives of the United States Army Corps of Engineers, the Commonwealth of Virginia and the State of Maryland.

NABPL-C

7 February 1980

Mr. Jeremiah Valliant
President and Chief Executive Officer
Citizens Program for Chesapeake Bay
P.O. Box 215
Oxford, Maryland 21654

Dear Mr. Valliant:

During your November meeting with Mr. A. Robinson of my staff, he noted that we were in the process of preparing a document detailing the plan for public participation activities to be carried out during the problem solving phase of our Chesapeake Bay Study. It was agreed that comments on it by members of the Citizens Program for Chesapeake Bay would be desirable. The draft of this document is now completed and we are inclosing one copy of it for your personal review.

Mr. Robinson has talked with Fran Flanigan and she has suggested that he send several copies of the report to her for distribution to other members of the program. We are, therefore, by separate letter, forwarding two copies of the report to Ms. Flanigan. Thank you very much for your cooperation.

Sincerely yours,

1 Incl
As stated

WILLIAM E. TRIESCHMAN, Jr.
Chief, Planning Division

NABPL-C

Mr. John E. Wilson
Acting Secretary
Department of Natural Resources
and Environmental Control
Edward Tatnall Building
P.O. Box 1401
Dover, Delaware 19901

W

Dear Mr. Wilson:

At the 16 January 1980 meeting of the Chesapeake Bay Study Advisory Group, a discussion was held concerning the five existing task groups on the study and the role that they would have in the final phase of the study. Although these groups had served well during the first two phases, it was becoming apparent that a reorganization was desirable for the final phase. It was agreed that the groups, as organized along "resource category" lines, would have little meaning for this phase and that the work could best be accomplished by groups organized along specific study lines. It was, therefore, agreed by the Advisory Group to replace the five existing work groups with two new groups; the Tidal Flooding Task Group which would provide input to the Tidal Flooding Study and the Freshwater Inflow Task Group which would be responsible for both the Low and High Freshwater Inflow Studies. Descriptions of these studies are inclosed.

In order to establish these new groups, I am asking the members of the Advisory Group to appoint representatives to one or both of these groups. These representatives should be at the appropriate level whereby they will be able to work closely with my staff during the final phase of the Chesapeake Bay Study. Based upon the tasks to be performed during the remainder of the study, I would recommend that the State of Delaware have a representative from the Department of Natural Resources and Environmental Control on the Freshwater Inflow Task Group.

Since these groups will be activated shortly, I would appreciate hearing from you at your earliest convenience. If you should have any questions or need further information, please call Mr. Alfred E. Robinson, Jr., Chief, Chesapeake Bay Study Branch at (301) 962-2512.

Sincerely yours,

1 Incl
As stated

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

COULTER
...RETARY

STATE OF MARYLAND
DEPARTMENT OF NATURAL RESOURCES
TIDEWATER ADMINISTRATION
TAWES STATE OFFICE BUILDING
ANNAPOLIS 21401

301-269-2784

LOUIS N. PHIPPS, JR.
DEPUTY SECRETARY

April 14, 1980

Mr. Noel Beegle, Chief
Study Coordination and Evaluation Section
Chesapeake Bay Study Branch
Baltimore District, U.S. Army Corps of Engineers
P. O. Box 1715
Baltimore, Maryland 21230

Dear ~~Mr. Beegle~~ Noel:

The following comments pertain to the assessment of the Chesapeake Bay Study Public Involvement Program Final Study Phase Report on which a State review was requested. The following are comments to the Report:

1. In Section 1, *page 5, Identifying the Interested Public* - in which reference is made to the Maryland CZMP public information section; the assembling of a descriptive information piece on Bay area citizen advisory bodies is no longer a priority and may be omitted.

2. In Section 2, page 25, Alternative Public Involvement Measures - in which reference is made to the Maryland CZMP Coastal Resources Advisory Committee representatives; replace "two representatives" for local government list with "citizen and governmental representatives". Also, on page 32, reference to the use of a Delphi-type communication by the Maryland CZMP should state this undertaking as part of a staff-advisory committee training program to improve the working relationship between the Coastal Resources Division staff and the Coastal Resources Advisory Committee members.

3. Throughout the Report, "Coastal Zone Unit" should be changed to "Coastal Resources Division".

4. In Section 4, Analysis of the Most Effective Mechanisms - this is a good exploration of basic, useful techniques that are the framework of any public participation effort.

5. In Section 5, pages 55-56, Recommended Program - it appears as if the establishment of a new Citizen Advisory Committee, which has virtually no other role than to guide the public participation element, is not in keeping with the level of commitment and involvement with the affected public required under the Coastal Zone Management Act and in

place under Maryland's CZMP and complementary Bay programs. As proposed, the Advisory Committee has no direct and meaningful relationship in the Study's coordination structure involving the Advisory Group, Steering Committee and five task forces (pages 58-59). And, the provision for a single observer from the Advisory Committee to the Advisory Group may not be adequate for accountability purposes nor as the ultimate role for the public in resolving differences on Study progress not included in other public participation activities (budget allocations, contractual hiring, assessment criteria and developing alternative recommendations at various stages of Study progress).

6. As for Public Meetings and Workshops - the experience of public participation programs in dealing with Chesapeake Bay issues and plans indicates very little new, meaningful information is derived from such meetings for use in such a complex and technically-oriented study. Instead, it is recommended that meeting emphasis be reoriented toward establishing working relationships with crucial existing advisory bodies in the Bay region which can help provide thorough, representative public comment with other on-going Bay research and management activities. These groups are also capable of assisting in determining need and sponsoring public meetings to obtain citizen comment still considered important to the Corps that otherwise cannot be found. Workshops, when coordinated with existing advisory body expertise and professional human relations consultants can better assure that valid, lasting recommendations are forthcoming which benefit participants invited as well as those unable to attend but affected by the subject matter.

In summary, what is recommended is that the Corps representatives consider meeting with public participation staffs of Maryland and Virginia Bay-related programs to enable consideration of alternative suggestions for designing a citizens advisory committee and related activities built on existing public participation resources that can better assure active, knowledgeable involvement which supports the Corps study efforts. The design of the program is well-intentioned, but it fails to get much beyond a strong public education and information exchange strategy. If that remains as the Corps objective, then a budget of $527,000 to accomplish that work seems excessive, particularly since it does not include a way to demonstrate or evaluate the effectiveness of the public involvement effort.

Should you have any questions, please do not hesitate to call me at (301) 269-2784.

Sincerely yours,

Sarah

Dr. Sarah J. Taylor, Director
Coastal Resources Division

Citizens Program for the Chesapeake Bay, Inc.

George M. Hagerman
Executive Director
5 East Queens Way
Hampton, Virginia 23669
(804) 723 0774

September 10, 1980
L-956-80

Mr. William E. Trieschman, Jr.
Chief, Planning Division
Department of the Army
Baltimore District Corps of Engineers
P. O. Box 1715
Baltimore, Maryland 21023

Dear Mr. Trieschman:

In reply to your letter of August 1, 1980, the following comments are made.

The subject of the Citizens Program for the Chesapeake Bay, Inc. (CPCB) being involved in the Corps' public participation program as outlined in your letter was discussed at a recent *Board of Directors meeting*. *Mr. Ted Robinson of your* office also attended the meeting. The Board is proud of the fact that CPCB has been involved with the Corps during their Chesapeake Bay Existing Conditions and the Chesapeake Bay Future Conditions reports. The Board feels that the uniqueness of CPCB was a significant factor in the contribution that CPCB was able to make to these studies.

The Board would like to participate in the three current studies as outlined in your letter. However, the situation within CPCB has changed during the past few years. As you are aware, CPCB is now actively engaged in three separate grants. These include the EPA Chesapeake Bay Public Participation Program, the Development of a Chesapeake Bay Use Ethic, and a mini-project program from the Virginia Environmental Endowment.

At this time the Board is reluctant to undertake the role of a Citizens Advisory Committee (CAC) on a purely volunteer basis. The Board also feels that this would be a serious moral commitment to the Corps. On a strictly volunteer basis they are not certain that they could completely honor this commitment. For example, the representative of the CAC to the

Chesapeake Bay Study Advisory Group should be a single individual to insure continuity. Even if there was one member in Virginia and another in Maryland to attend meetings held in the respective states, there would be a loss in continuity. Any further dilution of these representatives would result in all loss of continuity. This same reasoning can be applied to the representatives to the *Tidal Flooding and Freshwater Inflow Task Groups*. In addition to require a member of the CAC to participate in all public meetings and workshops at his own expense is just something that CPCB feels that it cannot guarantee.

In response to the second aspect of the program outlined in your letter CPCB, at this time, is not interested in being a contractor. At a later date we might be interested in scheduling and conducting workshops.

In closing we would like to emphasize that CPCB feels that it made a valuable contribution to the two previous studies and hopes that the District Engineer can make appropriate arrangements whereby CPCB can continue its assistance to the Corps of Engineers.

If you require any additional information, please do not hesitate to contact us.

Yours for a Better Bay,

George M. Hagerman
Executive Director

GMH/cac
cc: CPCB Board of Directors

THE KENT ISLAND HERITAGE SOCIETY, INC.
Stevensville, Maryland 21619

October 20, 1980

Col. James W. Peck
District Engineer
Department of the Army
Baltimore District - Corps of Engineers
P. O. Box 1715
Baltimore, Maryland 21203

Dear Col. Peck:

In accordance with my conversation with Mr. Robinson, I would like to make a formal request for the use of the facilities at the Chesapeake Bay Model for the major events taking place during the three days of Kent Island's 350th Anniversary Celebration which will be held on August 14, 15, 16, 1981.

At the present time our plans include a formal opening ceremony, a pageant and concerts. We will be pleased to provide you with additional information as our plans become more specific.

Your consideration of this request will be greatly appreciated.

Very truly yours,

Julius Grollman

Julius Grollman, Chairman
Kent Island's 350th Anniversary
Steering Committee

jg/mw

THE PLANNING FOR THIS EVENT IS IN THE VERY PRELIMINARY STAGES. MR GROLLMAN WAS CALLED ON THE TELEPHONE ON 10 NOV 80, AND VISITED ON 21 NOV & 4 DEC 1980. THERE ARE NO MORE SPECIFIC NEEDS STATED FOR THE CELEBRATION OTHER THAN PARKING.
MCK

NABPL-C

Mr. Julius Grollman
Chairman
The Kent Island Heritage Society, Inc.
P.O. Box 321
Stevensville, Maryland 21619

Dear Mr. Grollman:

This is in response to both your letter of 20 October 1980, and the conversation between you and Jim McKay of this office on 4 December 1980, concerning Kent Island's 350th Anniversary Celebration.

The Corps of Engineers will be pleased to cooperate with you and the Kent Island Heritage Society in this matter by making available the parking area at Matapeake for visitors. The use of facilities at Matapeake is granted contingent upon two conditions. The first condition is that in consideration of the Government's assent to the use of the parking area at Matapeake for visitors to the events taking place during Kent Island's 350th Anniversary Celebration, the Kent Island Heritage Society agrees to hold and save the United States free from damages due to the use of such facilities, except for damages due to the fault or negligence of the Government. The second condition is that the use of the facilities does not, in any way, interfere with the normal operation of the hydraulic model of Chesapeake Bay. In the light of the above, it is requested that this office be kept informed as the planning for this event progresses.

If there are any questions or comments concerning this matter, please call upon Ted Robinson or Jim McKay at (301) 962-2512 of this office at your convenience.

Sincerely yours,

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

NABPL-C

Mr. George H. Hagerman
Executive Director
Citizens Program for the
Chesapeake Bay, Inc.
5 East Queens Way
Hampton, Virginia 23669

Dear Mr. Hagerman:

Reference is made to your 10 September 1980 letter and subsequent conversations with Mr. Alfred E. Robinson, Jr. of my staff regarding Citizen's Program for the Chesapeake Bay, Inc. (CPCB) participation as the Citizen Advisory Committee for the Corps' Chesapeake Bay Study.

As you are aware, CPCB was invited to serve as the Citizens Advisory Committee for several reasons to include the diversity and geographical representation in your organization, the outstanding service that you provided on the earlier phases of our study and the credibility your organization has established through your on-going work for the Environmental Protection Agency. In examining your reasons for declining our offer I can appreciate your concerns that to insure quality input from your organization requires a strong commitment and continuity of representation on the various elements of our study organization. Considering the geographical extent of the study area, I can also appreciate that the travel expenses associated with attending our study meetings could be a considerable burden for any individual to assume.

While I recognize the merits of the above arguments, I still feel very strongly that citizen advisors, either individually or collectively, should serve in a completely volunteer capacity as it relates to serving on committees designed to provide citizen input to our studies. I believe it is in the best interest of both the individual and the Corps not to present the appearance of having "paid" advisors that could be accused of not presenting an objective viewpoint on matters as important as the future of Chesapeake Bay.

Given my above position that citizen services must be voluntary and that the costs associated with individual travel will be substantial, it is my intention to forego the concept of creating one Bay-wide citizen committee and to adopt a more "informal" means of citizen coordination. Under this approach we would pursue citizen input through coordination with existing Bay-wide and regional citizens groups such as CPCB and the State of Maryland's Coastal Resources Advisory Committee. Comments and/or review would be solicited from all groups and each group would provide input within the capability of their own resources. Please be assured that we will continue to keep CPCB advised of study progress and to seek your views relative to our study process and findings.

Thank you for your efforts in considering our proposal and I hope we can continue to work together to plan for the best use of the Bay and its resources.

Sincerely yours,

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

410 Henderson Road
Severna Park, Md. 21146
March 9, 1981

Col. James W. Peck, District Engineer
Corps of Engineers
P.O. Box 1715
Baltimore, Maryland 21203

Dear Col. Peck,

As a Director of the Citizens Program for the Chesapeake Bay, Inc., I have received a copy of your 9 February 1981 letter to Mr. George M. Hagerman concerning participation of CPCB, Inc. as the Citizen Advisory Committee for the Corps' Chesapeake Bay Study.

Your position that citizen services must be voluntary is understandable and has not been questioned. It is doubtful the Corps budget could cope with the fees normally received by qualified citizens for their services. However, your further position that such citizen volunteers should also pay their expenses associated with such services is rather contrary to my understanding of U.S. Government policy.

Citizens who may volunteer for such services to the Corps or any other branch of the U.S. Government have already paid Federal taxes from which Congress has authorized programs such as the Corps'. To expect such citizens to pay expenses for free service to the Corps is, in effect, requesting that they pay additional taxes for donating their services to the Government. It would be interesting to know if the Congress intended such action when they specified citizen participation as part of the Corps Chesapeake Bay Study.

Over the years I have been associated with many Federal programs, both as a volunteer and as a contractor. This is the first time I have ever experienced a Government agency indicating it expected a private citizen to help financially support a Government program by paying his expenses as well as donating his time and experience.

My thoughts expressed herein are my own, and are not necessarily those of other Directors of CPCB, Inc. Our Directors did meet several months ago, and at that time agreed that in view of the previous work done for the Corps Chesapeake Bay Study at our own expense, and the extent of the work outlined by your Mr. Alfred E. Robinson, Jr., they did not feel justified in participating unless the associated out-of-pocket expenses would be paid by the Corps. I, for one, cannot accept your viewpoint that reimbursement for expenses incurred would "present the appearance of having paid advisors."

For several years I have enjoyed working with Mr. Robinson and several other of the Corps staff. In the future I stand ready and willing to assist further in any way possible, provided expenses incurred specifically for such work is reimbursed.

Sincerely,

E. Gordon Riley

NABPL-C

2 April 1981

MEMORANDUM FOR THE RECORD

SUBJECT: Chesapeake Bay Information Center (CBIC)

1. Meeting held at National Wildlife Federation, Washington, D.C., to discuss formation of CPCB's Chesapeake Bay Information Center. Agenda and list of attendees are attached.

2. A National Science Foundation grant has been awarded to CPCB to set up the Information Center in conjunction with NSF's mandate from Congress to "support and foster science education in the U.S.A.". People will identify the problems, CBIC will provide the information. Purpose of Center will be to foster information exchange from scientists, politicians, and engineers to policy makers in the public sector (business, commerce, shipping, farm organizations, urban groups, etc.).

3. By March 1982, a plan is to be developed for the Information Center. Following a workshop scheduled for 11-12 June in Fredericksburg, a planning committee will be formed to make policy decisions and run the 11 month development project. A subcommittee will also be formed to do the actual work in development of the plan:

a) inventory existing information systems.
b) determine role of media in Chesapeake Bay affairs.
c) uses for conflict resolution.
d) survey techniques to apply technical data to assessment of issues.
e) determine kinds of data needed.
f) determine set-up, staff, budget, location, etc., for Information Center.

4. It was noted that it will be difficult for the Center to avoid appearance of advocate for or against a project. Also, many groups (watermen, marine trade recreationists, environmental groups, etc.) have been already identified in Fran Flanigan's Citizen's Program for EPA. It was also noted that the Chesapeake Research Exchange (CREX) will interface as an element of CBIC. CREX has as a goal to enable public to have access to <u>current</u> (and possibly past) research to aid in policy decision making.

5. Another organizational meeting is scheduled for Monday, May 11, 1981.

STEGNER

2 ATTACH.

NABPL-C 22 APR 1981

Mr. E. Gordon Riley
Director, Citizens Program for
Chesapeake Bay
410 Henderson Road
Severna Park, Maryland 21146

Dear Mr. Riley:

This is in reply to your letter of 9 March 1981 in which you expressed concern over my decision relative to the payment of travel expenses for volunteers participating on a Citizens Advisory Committee for the Chesapeake Bay Study.

I believe that the success of a planning effort is enhanced by the full consideration of the views of the private citizen. In the past, the effectiveness of using a Citizens Advisory Committee to assist in ascertaining these views has been clearly demonstrated through the participation of the Citizens Program for Chesapeake Bay in our Chesapeake Bay Study.

I am not sure, however, that the concept of one bay-wide Citizens Advisory Committee is still a workable one. If such a committee is to function effectively, it must meet fairly regularly and at least one of its members should attend the Advisory Group and Task Group meetings. As you pointed out in your letter, however, some expenses would be incurred in participating in such activities. I understand that some citizens could consider this to be an undue burden.

I am not proposing that private citizens financially support a government program as suggested in your letter. I will contract for technical expertise beyond the District capability that I feel is necessary for the study effort. I am seeking input from citizens who have an interest and desire to contribute a different perspective and who are motivated by their concern for the Bay and the outcome of the study. I know that this concept can be successful because I receive citizen input from individuals and ad hoc

committees for several other studies and none receive (or have asked for) reimbursement.

After consideration of the special problems imposed in obtaining citizen participation from the large geographical area covered by the Bay, I have reached the conclusion that citizen input to the Chesapeake Bay Study must be garnered through means other than a bay-wide Citizens Advisory Committee. I am, therefore, presently in the process of formulating a program that will achieve maximum possible citizens input with a minimum of expense for the private citizen. One of the keys to the success of this program is the continued active participation of you and the rest of the members of the Citizens Program for Chesapeake Bay.

I appreciate the fact that you took the time to write to me. The views of a person such as you, who expresses his concern for Chesapeake Bay through many hours of unselfish volunteer work, are particularly important to me. I trust that we will continue the valuable relationships we have enjoyed.

Very truly yours,

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

NABPL-F

7 DEC 1981

Dr. Robert Lippson
National Marine Fisheries Service
Lab for Ecology and Pathology of
Marine Organisms
Oxford, Maryland 21654

Dear Dr. Lippson:

Upon completion of the Norfolk Harbor Channels Deepening Test at the end of December, the hydraulic model of the Chesapeake Bay will be placed in a state of operational readiness until June, 1982.

During the period of operational readiness, the hydraulic model and its appurtenances will be maintained, by a minimum staff, in condition to be able to respond within a very short period of time to requests for testing.

The Corps of Engineers would like to make this period of time between January and June available to other governmental agencies or educational institutions for testing that they require on a cost reimbursable basis. Time for testing will vary as to the size of the test required, the number of people to do the test, and the amount of model preparation required for individual tests. The time will vary from a few days to a few weeks. In turn, it may be possible to run two small tests simultaneously, effecting significant economics for all concerned.

It is requested that hydraulic model testing requirements for your organization be forwarded to this office as soon as possible. If you have any questions concerning this matter, please call upon Mr. A. E. Robinson, Chief, Chesapeake Bay Study Branch at (301) 962-2512.

Sincerely,

JAMES W. PECK
Colonel, Corps of Engineers
Commander and District Engineer

1983 CHESAPEAKE BAY CONFERENCE

April 14, 1983

Colonel Gerald C. Brown, Commander
Baltimore District, Corps of Engineers
Post Office Box 1715
Baltimore, Maryland 21203

Dear Colonel Brown:

In October, 1982, the Governors of Maryland and Virginia announced their intention, together with the Chesapeake Bay Commission, to convene a conference concerning the Chesapeake Bay. Now set for December 7, 8, and 9, 1983, at George Mason University, Fairfax, Virginia, the dual purpose of this conference is to identify public policy issues related to the Chesapeake and its watershed and to recommend changes to protect and enhance the living resources of this unique tidal system.

Sponsored by the Commonwealth of Virginia, the State of Maryland, the Chesapeake Bay Commission, EPA's Chesapeake Bay Program, and the District of Columbia, the conference is being designed to fulfill the need for public education, awareness, and involvement in a concerted action effort. It will be managed by the Citizens Program for the Chesapeake Bay, Inc.

To aid in this challenging task, we are encouraging the active participation of the Commonwealth of Pennsylvania, the federal government, state agencies, research institutions, and private organizations.

The conference will be preceded by a series of intensive workshops designed to produce issue papers and recommendations to be presented to the full conference. Goals include clarification of policies, solutions to problems, and formulation of an action plan to be presented at the conference.

We are inviting you to join us in this challenging process by participating in important pre-conference workshops. Since the vital focus of this conference is on design of regional solutions to problems of conflicting use and resource protection, it is particularly appropriate and very important that the Corps of Engineers' Chesapeake Bay Study be involved.

Colonel Gerald C. Brown
April 14, 1983
Page Two

Our planning group will be asking you to name a senior staff member to help in the critical process of translating ideas into stated goals and commitments. Frances Flanigan, Conference Manager for CPCB, and workshop chairperson will be in touch with you to discuss appropriate participation from your organization. We look forward to having your contribution to this challenging project.

Sincerely,

Betty J. Diener, Secretary of Commerce and Resources Commonwealth of Virginia	Joseph V. Gartlan, Jr. Chairman Chesapeake Bay Commission	Torrey C. Brown, M.D. Secretary, Department of Natural Resources State of Maryland

May 10, 1983

Planning Division

Mrs. Frances Flanigan
Citizens Program for the
Chesapeake Bay
6600 York Road
Baltimore, Maryland 21212

Dear Mrs. Flanigan:

This is in reply to the April 14, 1983 letter from Ms. Betty J. Diener, Secretary of Commerce and Resources of the Commonwealth of Virginia, Mr. Joseph V. Gartlan, Jr., Chairman of the Chesapeake Bay Commission, and Dr. Torrey C. Brown, Secretary of the Department of Natural Resources for the State of Maryland, requesting our help in planning for the 1983 Chesapeake Bay Conference. We would be glad to participate in this function. Mr. A.E. (Ted) Robinson, will attend the pre-conference workshops. As you know, Ted is my staff person responsible for the Chesapeake Bay Study. Also, I would appreciate the opportunity to present a paper on the Chesapeake Bay Study.

Please feel free to call upon us if we can be of any further help or if you would like us to present papers on any other aspects of our work.

Sincerely,

Gerald C. Brown
Colonel, Corps of Engineers
District Engineer

Copy furnished:
Ms. Betty J. Diener
Mr. Joseph V. Gartlan, Jr.
Dr. Torrey C. Brown

ATTACHMENT B-5

COMMENTS AND RESPONSES ON DRAFT FINAL REPORT

ATTACHMENT B-5
COMMENTS AND RESPONSES ON DRAFT FINAL REPORT

Table of Contents

NATIONAL SCIENCE FOUNDATION
WASHINGTON D.C. 20550

April 3, 1984

Mr. William E. Trieschman, Jr.
Chief, Planning Division
Department of the Army
Baltimore District Corps of Engineers
PO Box 1715
Baltimore, Maryland 21203

Dear Mr. Trieschman:

This letter is in response to your letter of March 27 and receipt, under separate cover, the draft of the Final Report, Chesapeake Bay Study. I appreciate your providing the chart that explained the organization of the report and suggest its incorporation into the Summary Report volume to assist the reader.

I have limited my review to date of the first three volumes and decided to call your attention to the points noted to date in the event I do not have time to do more. The points noted are as follows:

1. On page 1 of the Summary Report, the sentence:(line 7) "Unfortunately, problems sometimes arise when people's use of the resources conflict with the natural environment or other intended uses," doesn't make "sense." A better "bridging" sentence between the two where it lies might read something like: "These activities may conflict with each other in competing for the limited resource values of the natural environment."

2. On page A-44 of Supplement A, the title of the paragraph "Raparian" should be "Riparian."

3. Typographical errors in Supplement B noted are:

   On page 41, it's Richard H. Demmy (not Richary).

   On pages 81 and 83, Dr. Niering's tenure is noted as being "1968-68." If it was for only one year, it probably should read simply "1968."

I hope you find these comments of value.

Sincerely yours,

Edward H. Bryan, Ph.D., Program Director,
Environmental and Water Quality Engineering

EHB/eb

COMMENTS INCORPORATED AS NOTED

STUART W CONNOCK
DIRECTOR

COMMONWEALTH of VIRGINIA

Department of Planning and Budget

POST OFFICE BOX 1422
RICHMOND 23211
(804) 786-7455

April 5, 1984

Colonel Gerald C. Brown
District Engineer
Baltimore District
U.S. Army Corps of Engineers
P.O. Box 1715
Baltimore, Maryland 21203

ATTN: Mr. Ted Robinson

Dear Colonel Brown:

This letter is to inform you of the manner in which the Commonwealth of Virginia will review the final volumes of the Corps' Chesapeake Bay Study. As the state's "single point of contact" for the review of the wide range of federal documents, I am notifying you that the Council on the Environment will work with state agencies and institutions to develop a state response to the Bay Study documents. Virginia's planning district commissions are being asked to send their comments directly to the Baltimore District.

Sincerely,

Robert H Kirby

Robert H. Kirby
Intergovernmental Review Officer

RHK/5677/MPAS/nb

COMMONWEALTH of VIRGINIA

Marine Resources Commission

P. O. Box 756
2401 West Avenue
Newport News, Virginia 23607 -0756
Telephone: 247 2200

May 9, 1984

Mr. Charles Ellis, III
Council on the Environment
903 Ninth Street Office Building
Richmond, Virginia 23219

Dear Charlie:

This responds to Mr. Kirby's letter to Mr. Pruitt of April 3, 1983 asking that we review the Baltimore District, U. S. Army Corps of Engineers Chesapeake Bay Study and provide written comments to you by May 14, 1983.

We have reviewed the three summary reports but, because of a lack of technical expertise, have made no effort to review the technical or scientific accuracy of the fifteen, supporting volumes.

<u>General Comment:</u>

1. The study embraces the period 1967 through 1983, a period of 16 years. It is generally well recognized that this was a period of sharply increasing environmental awareness and rapidly developing environmental regulatory programs at all levels of government. Additionally, the scientific body of knowledge was expanding dramatically. Evaluation of the Summary Reports leads one to question whether the study kept pace with either development. Since much of the effort was apparently an elaborate literature search, this is probably to be expected.

2. In spite of the sobering sums of public funds expended on this and similar research into the problems of the Bay, it is disconcerting to note the number of recommendations which advocate yet more research.

<u>Specific Comments:</u>

A. Summary Report

1) In spite of the responsibilities of the Marine Resources Commission in living resource and marine habitat management, this agency is conspicuously absent; particularly on page 33.

2) Study Organization, Figure 23, page 107, indicates involvement by Virginia on 7 important committees. In spite of extensive telephone

research, I have found no one willing to acknowledge even modest participation. (It may well be that Dr. Hargis did participate extensively but because of unavailability, I have not been able to confirm his involvement). I have, however, obtained the names of all other persons listed by the Baltimore District as participants on one or another of the committees. All of the representatives reportedly appointed to the Present Conditions Study have long since retired, moved or are otherwise inaccessible. Many of those on the Future Conditions Study appear to fit that category as well. Similarly, those currently credited with contributing in a significant way to the study would, I believe, be surprised to find themselves so classified.

In summary, I am of the distinct impression that participation by Virginia representatives was extremely limited because little or nothing was asked of them after appointments were made.

B. Low Freshwater Inflow Study - Main Report

1) Page 37. Detailed Tidal Marsh Inventories conducted by VIMS show there are 215,000 acres of vegetated tidal wetlands in Virginia, vice the 90,000 acres shown.

2) Pages 53-55 under State and Local agencies, no mention is made of this agency.

3) Page 88. (a) Fisheries Management. Plans should eventually address problems such as low flow.

(b) SAV Reestablishment. The conclusion regarding reestablishment of SAV beds seems inconsistent with *Chesapeake Bay Initiatives* to fund such an effort.

(c) Oyster Bed Restoration. Virginia has a similar long-established and reasonably successful program which should be mentioned.

4) Page 101 and table V-1. Finfish restocking Bay wide appears to be a *ludicrous alternative. To be effective, the size of such a facility* would defy both imagination and sources of funds to support such an effort.

C. Tidal Flooding Study - Main Report

No specific substantive comments are offered.

Sincerely,

Norman E. Larsen
Assistant Commissioner for
Environmental Affairs

NEL/slp
EV
CC: Mr. William A. Pruitt
Mr. Robert H. Kirby
Mr. Jack Travelstead

COMMONWEALTH of VIRGINIA

Office of the Governor
Richmond 23219

Betty J. Diener
Secretary of [illegible]

June 7, 1984

Mr. William E. Trieschman, Jr.
Chief, Planning Division
Baltimore District
U. S. Army Corps of Engineers
P. O. Box 1715
Baltimore, MD 21203

Dear Mr. Trieschman:

The Commonwealth of Virginia has completed its review of the draft of the Final Report of the Chesapeake Bay Study. Our review of this document was coordinated by the Council on the Environment with cooperation from the Department of Planning and Budget, whose Intergovernmental Review Officer has been designated as the State's Single Point of Contact for receipt of federal review documents. The following state agencies and institutions took part in this review:

State Water Control Board
Office of Emergency and Energy Services
Department of Health
Marine Resources Commission
Virginia Port Authority
Virginia Institute of Marine Science
University of Virginia
Old Dominion University
Virginia Polytechnic Institute and State University.

Local governments and regional planning district commissions are commenting directly to you.

In general, the Commonwealth has no significant comment to make on the draft study documents. The entire set of Study documents provides necessary background information and the Low Freshwater Inflow and Tidal Flooding Studies will be useful planning documents.

Mr. William E. Trieschman, Jr.
Page Two
June 7, 1984

As was noted in your draft documents, the Study, despite its many accomplishments, fell somewhat short of its initial expectations because of funding and technical constraints. Comments on these and other points are attached.

Thank you for the opportunity to comment on this document. When you are ready to distribute the final version, please contact Larry Minock of the Council on the Environment, (Ninth Street Office Building, Room 903, Richmond, VA 23219, or telephone 804/786-4500) regarding the number of copies needed by Virginia agencies and institutions.

Cordially,

Betty J. Diener

CC: Ms. Sheila M. Prindiville, Council on the Environment
Mr. Richard N. Burton, State Water Control Board
Mr. Norman E. Larsen, Virginia Marine Resources Commission
Mr. R. Todd Coyle, Virginia Port Authority
Mr. Addison E. Slayton, Jr., Office of Emergency and Energy Services
Dr. Alfred B. Rollins, Jr., Old Dominion University
Dr. Frank L. Hereford, Jr., University of Virginia
Dr. Frank O. Perkins, Virginia Institute of Marine Science
Mr. Robert H. Kirby, Department of Planning and Budget

COMMONWEALTH of VIRGINIA

Virginia Port Authority
600 World Trade Center
Norfolk, Virginia 23510
Cable Address Vasports
Telephone 804-623-8000
TWX 710 8811231

J. Robert Bray
Executive Director

May 10, 1984

MAY 1984
Council on the Environment

Mr. Charles H. Ellis, III
Environmental Impact Coordinator
Virginia Council on the Environment
903 Ninth Street Office Building
Richmond, Virginia 23219

Dear Charlie:

Enclosed are our comments on the Chesapeake Bay Study.

If you have any questions, please call me.

Sincerely yours,

Todd

R. Todd Coyle
Director of Planning

RTC/cw
Enclosure
cc: Mr. Robert H. Kirby

2. A need for an economically and environmentally acceptable method of dredge material disposal. In the Baltimore area, maintenance dredging by the Corps of Engineers and other public and private interests has been repeatedly delayed because of the lack of agreement on an economically and environmentally acceptable disposal site for the dredged material. While the State of Maryland has constructed a containment area for dredged material at Hart and Miller Islands near Baltimore Harbor, this disposal area will not completely satisfy long term disposal needs. The dredge material disposal situation has not been nearly as critical in the Hampton Roads area as in Baltimore due to the existence of the Craney Island Disposal Area in the middle of the Hampton Roads port complex. ~~This site is nearing its capacity, however, with complete filling expected in the early 1980's.~~ Dredge material disposal in the smaller waterways and harbors is normally not a problem.

Insert A

3. A need to alleviate potential congestion problems in port, channel, and anchorage areas. As vessel traffic on Chesapeake Bay increases in the future, congestion will also probably increase. Increased congestion means the potential for accidents and the resultant discharge of hazardous substances into the water may also increase. The problem may be compounded by the location of a liquid natural gas handling facility at Cove Point, Maryland, which began operation in 1978, and the potential location of several new petroleum refineries in the Region. The traffic associated with these facilities would significantly increase the level of potentially hazardous substances moving on the Bay.

4. A need to minimize the potential conflicts between commercial and recreational users of the Bay's waters and beaches. Recreational fishing and boating can be disrupted by the wakes from passing ships. In addition, large areas of the Bay and its tributaries are precluded from recreational uses because of their use as anchorages, ship channels, or dredge disposal areas by commercial navigation interests and/or the military. On the other hand, large commercial and military vessels must be constantly on the alert for the smaller recreational vessels to avoid collisions or swampings.

5. A need to minimize the erosion damages from waves caused by commercial and military vessels. In some areas of the Bay Region (e.g., the area around the Elk River entrance to the C&D Canal) the wave action caused by passing ships is a major cause of shoreline erosion.

6. A need to provide additional lands to accommodate expanding port facilities. The development of a major port is dependent on the concurrent development of land-based port-related facilities. However, the development of shoreline land for terminal facilities may in some cases conflict with existing wetlands or proposed recreational use of the same land. In addition, port-related facilities, because of their location, may be subject to tidal flooding and shoreline erosion.

TIDAL FLOODING

THE TIDAL FLOODING PROBLEM

Since man first settled on the shoreline of Chesapeake Bay, he has been subject to periodic tidal flooding which has resulted in immeasurable human suffering and millions of dollars of property damage. Serious tidal flooding in the Chesapeake Bay Region is caused by either hurricanes or "northeasters." Hurricanes which reach the Middle Atlantic States are usually formed either in the Cape Verde Region or the western Caribbean Sea and move westerly and northeasterly direction in the vicinity of the East Coast of the United States.

Summary Report. Supplement A.
· Problem Identification.

Insert A

Total dredging requirements over a 50 year project life for a deepened Norfolk Harbor and associated channels, including new work dredging *and future maintenance*, would be approximately 380 million cubic yards. Disposal of this quantity is planned to be divided primarily between Craney Island Disposal Area and other approved alternative disposal sites, including ocean disposal.

Insert B

The Norfolk District Engineer has recommended that the channels be deepened. Congressional approval is pending.

MEMORANDUM

State Water Control Board

2111 North Hamilton Street · P. O. Box 11143 · Richmond, VA. 23230

SUBJECT: REVIEW OF THE CORPS, CHESAPEAKE BAY STUDY (SUMMARY)

TO: LARRY MINOCK

FROM: JOHN ROLAND JWS jr JVR

DATE: JUNE 6, 1984

COPIES: FILE

JUN 1984 Council on the Environment

We have reviewed the Corps report entitled: "Draft, Chesapeake Bay Study," and have the following comments to offer:

1) We have a major concern that the study area did not include the entire Chesapeake Bay drainage. Not only did their study area stop at the fall lines, but it appears that some of the study area was outside the drainage basin. By excluding areas above the fall line and including areas outside the basin the results of their findings and evaluations are misleading.

2) Page 33, Table 5. Under the Virginia agencies list the Virginia Soil and Water Conservation Commission should be listed.

3) Page 118. Hampton Roads area should also include the City of Newport News.

4) Page 121, Recommendations. A storm surge model has already been developed by VIMS.

5) Page 122. Many of the recommendations listed are being addressed via the EPA Chesapeake Bay Program.

Should you have any additional questions regarding these comments, please feel free to call.

:nep

CHARTERED 1693

COLLEGE OF WILLIAM AND MARY

VIRGINIA INSTITUTE OF MARINE SCIENCE

SCHOOL OF MARINE SCIENCE

Gloucester Point, Virginia 23062 · Phone (804) 642-2111

May 15, 1984

Mr. Charles H. Ellis, III
Council on the Environment
903 Ninth Street Office Building
Richmond, Virginia 23219

Dear Mr. Ellis:

We have reviewed the draft of the final report on the Chesapeake Bay Study by the U.S. Army Corps of Engineers and have no suggestions for revisions or additions. The lack of comments is due to the quality of the work and the prior involvement of VIMS' personnel during the development of the documents.

Thank you for the opportunity to review this important contribution.

Sincerely,

Frank O. Perkins

Frank O. Perkins
Dean/Director

FP:jmr

cc: Mr. William E. Trieschman, Jr., Chief, Planning Division, Baltimore District, U.S. Army Corps of Engineers
Mr. Robert H. Kirby, Intergovernmental Review Officer, Department of Planning and Budget, Commonwealth of Virginia

OLD DOMINION UNIVERSITY
NORFOLK VIRGINIA 23508

Office of the President

MAY 1984
Council on the Environment

May 11, 1984

Council on the Environment
3600 West Broad Street
Richmond, VA 23230

TO: Council on the Environment

FROM: *Alfred B. Rollins, Jr.*
President

As requested by Mr. Kirby, the Commonwealth's Intergovernmental Review Officer, I have asked our experts to review the final report of the Chesapeake Bay study conducted by the Corps of Engineers. Their comments are provided herewith for your information.

ABR/svb

Enclosure

cc: Robert H. Kirby,
Intergovernmental Review Officer
Department of Planning and Budget

OLD DOMINION UNIVERSITY MARINE SCIENCE FACULTY COMMENTS
ON THE CHESAPEAKE BAY STUDY
BY THE BALTIMORE DISTRICT CORPS OF ENGINEERS

We found the objectives of the studies were quite ambitious: 1) to assess the existing chemical, biological, economic and environmental conditions of the Chesapeake Bay; 2) to project the future water resource needs of the Bay region to the year 2020; and 3) to formulate and recommend solutions to priority problems using the Chesapeake Bay Hydraulic Model. Reports summarizing the findings of studies designed to address the first two objectives were published in 1973 and 1978, respectively. The final report series currently under review summarizes all three areas, but emphasizes topics related to the third objective. The summary report has three supplementary volumes covering the areas of:

A. Problem Identification: Summarizes background, political, sociological, economics, environmental, regulatory and resources data on the Chesapeake Bay.

B. Public Involvement: Identifies organizations involved in the studies in question. It describes the organization and purpose of task forces on topics of concern. This volume also indicates how the public was to be informed and how comments, perceptions and desires were solicited from the public. The bulk of this particular volume consists of copies of correspondence received concerning the program.

C. The Chesapeake Bay Hydraulic Model: This volume consists of engineering, calibration and testing information on the Hydraulic Model.

Since these three report supplements are extremely detailed, and the basic information is presented in the summary report, we will only address our comments to this summary report.

The first sections of the summary report present the participants in the program. Numerous federal, state, and citizens groups were identified, but the only representative which I could find from the State of Virginia was Dr. Hargis. Therefore, I believe that participation was mainly from representatives of the State of Maryland. The background portion of this summary report summarizes the historical, environmental, land use and resource information for the Chesapeake Bay, as well as regulatory responsibilities and projected future demands.

The section on problems, needs and opportunities first describes nine major areas of concern: 1) water supply; 2) water quality (responsibility for this area was passed to EPA); 3) recreation; 4) navigation; 5) tidal flooding; 6) shoreline erosion; 7) fish and wildlife; 8) electric power; and 9) noxious weeds. Following the presentation of each of these areas, the criteria for selection of high priority areas

Navigation

There are three major Federal navigation projects in Hampton Roads. These are the Thimble Shoal, Norfolk Harbor, and Newport News Channels. These projects provide 45-foot deep channels which connect the Hampton Roads Harbor with the Atlantic Ocean. Insert B There are also a number of lesser depth channels. Private interests such as coal pier operators, shipbuilding and numerous maritime interests, as well as the U.S. Navy have dredged from the Federally maintained channels to their docks and piers. Dredging has also been done to improve navigation in the vicinity of marinas.

Water Quality

Point sources of water pollution may be defined as those continuous sources which are discharged to a receiving water body via an outfall structure, usually a pipe. Prior to its discharge, the wastewater is ordinarily treated to a specified level. Point sources may be composed of primarily domestic or process wastes or a combination thereof.

Within the Hampton Roads city complex, there are many existing municipal wastewater facilities. Additional facilities are programmed for construction. Practically all of these municipal facilities are owned and operated by the Hampton Roads Sanitation District Commission. Numerous municipal facilities in the area have undergone or are presently undergoing extensive expansion and upgrading construction programs to meet treatment requirements as mandated by the Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500). The Hampton Roads Sanitation District Commission is carrying out an aggressive construction program to bring facilities up to the level of secondary treatment. Construction programs are currently in progress to expand and upgrade existing residual solids disposal facilities. Digestion is the predominant disposal method in the area. The Hampton Roads Sanitation District Commission is presently investigating such techniques as sludge farming and sludge composting as potential methods of disposal.

The area contains many industrial facilities which discharge waste overboard to receiving waters. These discharges consist of process waste, cooling water, wash water, drydock discharges, and storm water runoff from site drainage. Military reservations and operations which discharge overboard to receiving waters are also assigned to this category. In Virginia, the Virginia State Water Control Board has issued National Pollutant Discharge Elimination System (NPDES) permits to industrial dischargers on a case-by-case basis. The majority of industries (excluding Federal facilities) are achieving their current NPDES permit limits for flow, BOD_5 and total suspended solids. Additional parameter limitations such as pH, temperature, and heavy metals are also in progress.

Nonpoint pollution may be defined as pollutants emanating from land activities transported to receiving waters during rainfall events and may be categorized as either discrete or diffuse. Generally, a storm sewer collection system or a defined drainage ditch is associated with the discrete type, whereas a diffuse type may be thought of as sheet runoff and has no collection system or defined point of discharge. Special non-point sources may include, but are not limited to, runoff from animal feed lots, solid waste disposal areas, coal piers, dredge disposal areas, large construction areas, large parking lots, and storage areas. In addition to the above special sources, marinas and

B-23

Tidal Flooding Study. Appendix B. Plan Formulation, Assessment and Evaluation

were stated. Basically, studies which maximize the use of the Chesapeake Bay Hydraulic Model, avoided duplication of effort elsewhere, and satisfied the intent of Congress in funding the Model were the ones to be selected. Two types of studies were identified. First, the resource study which was essentially an environmental management/planning study involving plan formulation, assessment and evaluation. The second type of study was a model study in which the Chesapeake Bay Hydraulic Model was used for testing or demonstrating a physical pattern. All in all, over four dozen potential studies were identified as being appropriate for the program. The section ends up with a dozen planning objectives based upon federal guidelines and environmental laws. Unfortunately, the entire section ends with a paragraph which indicates that due to financial and technical problems, only two studies were successfully completed despite the extensive program planning/justification phase presented in the report.

The next two chapters of the summary report summarize the two specific studies which were successfully completed. The first was what was classified as a resource study of the potential tidal flooding problem in the Chesapeake Bay region. The chapter presents the causes of flooding, lists the existing and future areas expected to have problems with tidal flooding and provides the criteria used for the screening of communities which were selected for the detailed planning/analysis phase of the study. Unfortunately, due to funding and technical problems, neither the Chesapeake Bay Hydraulic Model nor numerical models which may have aided in the prediction of areas potentially subjected to tidal flooding were used for this study. Rather, data on average annual damages and tidal stage-frequency information were used to produce damage-frequency relationships for each of the communities. These data were evaluated in light of the relative cost and effectiveness of solutions such as structural and nonstructural flood control alternatives. Although this approach may be entirely justified, we had concern over some of the data being used, particularly for the Hampton Roads area of Virginia. It was stated that although the cities of Hampton Roads were all classified in the "critically" flood prone areas, only the small community of Fox Hill was used in the evaluation due to intense development elsewhere. Exactly why the intense level of development in the Hampton/Norfolk/Chesapeake/Portsmouth region would preclude study is not clear and why Fox Hill should be considered representative of the region is not justified. Moreover, the data used for the Hampton Roads area was based upon flood damage reports which were over twenty years old at the time of study. Certainly, the development or redevelopment in the Hampton Roads region over the past twenty years would bring such a data base into question. A final problem with this particular study which was pointed out in the summary report is that no storm surge effects were taken into account when tidal flooding damage was evaluated. Particularly in our region, which the report states is the area of greatest incidence of storms such as northeasters on the east coast, this particular effect would quite likely overshadow many of the other aspects of tidal flooding.

The second study concerns the potential effects of low freshwater inflow into the Chesapeake Bay. The objectives of the study were: 1) to define the relationship between the magnitude of freshwater inflow

and the salinity patterns in the Chesapeake Bay; 2) to define socio-economic and environmental impacts due to short and long term reduction of inflow; and 3) to identify promising alternative solutions to problems caused by reduction in inflow. The basic problem with low freshwater inflow stems from the large growth of population in the Chesapeake Bay region. Consumptive use of water associated with population growth was shown by the tests run at the Chesapeake Bay Model to represent up to 50% of the total inflow into the system. Such a reduction of freshwater inflow may cause an increase in salinities of up to 5 parts per thousand throughout the mainstream of the Chesapeake Bay and be a particular problem in extending salt wedges up the estuaries. The primary problems identified concerned this change in salinity problem in decreasing the range of potentially beneficial species and increasing the range of potential nuisance species. Although these problems are certainly quite serious, other associated problems were completely ignored. For instance, the change in freshwater input would likely change nutrient input, flushing rates, non-tidal circulation patterns (particularly in estuaries), the migration of planktonic forms which may be affected by the change in circulation/stratification, and sediment transport processes which may be associated with the movement of the turbidity maximum zone (e.g. the sort of shoaling problems which have occurred in Charleston Harbor once freshwater input was artificially reduced).

In addition to the problems in assessing the potential effects of reduced freshwater flow into the Bay, the study proposed two potential solutions to the problem: conservation; and upstream storage of freshwater for release during periods of low inflow. We do not believe that either of these solutions would be very feasible. Conservation would appear to have a fairly small affect, particularly if there were no economic incentives (e.g. such as occurs during the water rationing of draught periods) and in view of an increasing demand associated with population growth. The upstream water storage alternative does not seem to fit with politico-economic realities: it is highly unlikely that upland counties will approve the use of land for reservoirs when the water resources will be used elsewhere. Such an opposition would be particularly strong during periods of draught when the water supplies would be lost from the region because the supply is being released into the Bay solely for the purpose of maintaining salinity patterns. Scientifically, we agree with the philosophy of trying to prevent the adverse effects of low freshwater flow into the Bay, but realistically, such a solution would only be feasible if the storage projects occurred on federal lands where local politics would not play such a major role. The Lake Gaston issue is a prime example of a similar sort of situation.

Much of the information in the summary report as well as in the supplementary documents may be particularly valuable in educating the public in the characteristics and resources of the Bay region and the potential problems which may be associated with man's use of the region. For this forum, we feel that the report is adequate although many of the sections could probably be cut down in size. If, on the other hand, the document is meant to be a technical report for the scientific community, I feel that the tone is quite simplistic and the information not sufficiently documented.

-1715

July 25, 1984

Planning Division

Ms. Betty J. Diener
Secretary of Commerce and Resources
Office of the Governor
Richmond, Virginia 23219

Dear Ms. Diener:

Thank you for your letter of June 7, 1984 transmitting Virginia's comments on the Chesapeake Bay Study draft report. We appreciate your effort in coordinating the review among the many state agencies and institutions. A paper is enclosed which addresses each of the Commonwealth's comments.

Should you have any questions regarding this matter, please call Mr. A. E. Robinson, of my staff, at 301-962-4710.

Sincerely,

William E. Trieschman, Jr.
Chief, Planning Division

Enclosure

STEGNER/pk/24710/NABPL-C

ROBINSON/NABPL-C

NELSON/NABPL

TRIESCHMAN/NABPL

ACCOMMODATION OF THE COMMONWEALTH OF VIRGINIA'S COMMENTS ON THE CHESAPEAKE BAY STUDY

Marine Resources Commission

General Comment

The findings and recommendations of each of the phases of the Chesapeake Bay Study were based on what were, at the time, the latest environmental regulatory programs and extent of scientific knowledge. The number of recommendations for additional research presented in our report are based on our study findings which show insufficient understanding of the Bay's physical, chemical, and biological processes. The nutrient budget, sediment transport processes, biological interactions, and ecosystem processes are examples of areas needing a better understanding. Both the assessment of the adequacies of plans already implemented and formulation of future plans are dependent on a better understanding of these processes.

Specific Comments

A. Summary Report

We have noted the Commissioner's comment on Virginia's participation in the Chesapeake Bay Study. We have attempted to emphasize public input, at all levels, throughout the study. All work was closely coordinated with the people designated by the Governors of the involved states and the heads of Federal agencies for participation on the Advisory Group, Steering Committee, and Task Groups. We are convinced that this public participation program has been an intensive one and has been conducted at a level consistent with the types of investigations done in the various phases of the study, the types of recommendations being made, and the recent revisions in scope dictated by available funding. In the final report, a table of acknowldgements has been prepared showing all participants, including many people from Virginia.

B. Low Freshwater Inflow Study - Main Report

The first two comments, relating to the inventory of tidal wetlands, and the listing of the Commission as a state agency have been incorporated.

To date, success in SAV bed re-establishment has been irregular in the Bay. Therefore, this option was not included as a most promising alternative in this study. However, we fully support current initiatives into research in this area, and encourage consideration of this option in all future planning.

Mention of the Virginia oyster bed restoration program has been incorporated in the report.

We agree that finfish restocking for Chesapeake Bay would be an ambitious undertaking, and probably questionable from a cost-benefit perspective. It has been retained as a promising alternative, however, in view of past successes, at a modest level, for selected species. More in-depth studies of the feasibility of finfish restocking are necessary before it can be included in an action plan for Chesapeake Bay.

Virginia Port Authority

All comments have been incorporated.

State Water Control Board

From the beginning of the Chesapeake Bay Study, the study area has included those counties or Standard Metropolitan Statistical Areas which are contiguous to, or have a major socio-economic or environmental interaction with, Chesapeake Bay. This area was selected through coordination with the study organization, which, as noted earlier, involved representatives appointed by the Governor of Virginia. To some extent, the area was dictated by the breakdown of socio-economic data, as prepared by the U.S. Department of Commerce.

The Virginia Soil and Water Conservation Commission has been added to the list of Virginia agencies.

Our study of the tidal flooding problem in Chesapeake Bay did not identify Newport News as one of the critically floodprone communities in the Hampton Roads area.

For the purposes of this study, a complete investigation was not conducted on the feasibility of structural measures in the entire Hampton Roads area. Rather, several small typical areas within Norfolk and Hampton were investigated relative to the applicability of structural measures.

Four areas along the Lafayette River and Wayne Creek in Norfolk were investigated to determine the feasibility of constructing tidal flood barriers at the four points where existing bridges crossed these small tidal streams. Based on field investigations, the above plans were not found to be practicable and no further analyses are included in this report. A fifth location investigated was the Fox Hill area of Hampton. The structural protection considered was a 6,200-foot floodwall that protected approximately 50 structures to the 100-year flood level.

As with the structural measures, no investigations were made of the entire Hampton Roads area relative to the feasibility of nonstructural plans. However, the Fox Hill area was chosen as a sample area for nonstructural plans. Based on a field survey of the 379 structures in Fox Hill, a sample area which includes 61 homes was selected for study. Two nonstructural plans which provided 25- and 100-year levels of protection for these 61 homes were developed. The nonstructural measures considered consisted solely of raising the existing structures.

The Corps has done a thorough investigation of tidal flooding surge models in Chesapeake Bay and believes that more sophisticated models are needed to resolve questions relative to frequency of occurrence.

We are encouraged that investigations by the EPA are proceeding along lines consistent with our recommendations.

Old Dominion University

An "acknowledgement" section has been added to the Summary Report which lists the representatives on the study from the Commonwealth of Virginia.

The major variable used in the assessment of the effects of low freshwater inflow was salinity. Other variables, such as nutrients, non-tidal circulation, etc., are insufficiently well know in terms of their end effect in the estuary due to a perturbation such as a reduction in freshwater inflow. Recommendations presented in our study reflect the need for additional research in many of these areas.

Conservation investigations from around the country have shown that savings of the magnitude shown can be realized. We acknowledge that the costs may be very high. However, the programs required would involve a combination of retrofitting of existing domestic and commercial facilities and revision of plumbing codes to make future water using appliances more efficient. Numbers shown include water savings in public-domestic-commercial, irrigation, and power water useage.

The Corps' assessment of the feasibility of upstream water storage, to alleviate the effects of reduced freshwater inflow, was focused primarily on hydrologic cost considerations. We have carefully framed the report so as to avoid the impression that we are recommending the construction of reservoirs. Reservoir storage, however, is one potential solution and we believe it should be retained for consideration, in future more in-depth analyses of flow needs for the Bay.

In general, the Chesapeake Bay Study has not been prepared as a technical document. The intended audience, especially for portions of the report such as the Summary and Main Reports, is the educated lay person and the Congress of the United States.

HARRY HUGHES
GOVERNOR

MARYLAND
DEPARTMENT OF STATE PLANNING
301 W. PRESTON STREET
BALTIMORE, MARYLAND 21201-2365

CONSTANCE LIEDER
SECRETARY

April 6, 1984

Mr. William E. Trieschman, Jr.
Chief, Planning Division
Department of the Army
Baltimore District
Corps of Engineers
P.O. Box 1715
Baltimore, MD 21203

Reply Due: May 7, 1984

State Identification Number: MD 84-4-507

State Clearinghouse Contact: Samuel Baker

RE: Chesapeake Bay Study

Dear Mr. Trieschman:

This is to acknowledge receipt of the referenced subject. We have initiated the Maryland intergovernmental review and coordination process as of this date. You can expect to receive review comments and recommendations on or before the reply date indicated. If you have any questions concerning this review, please contact the staff member noted above.

The State Identification Number must be placed on any financial assistance application form and used in future correspondence.

We are interested in the referenced subject and will make every effort to ensure a prompt review. Thank you for your cooperation.

Sincerely,

Guy W. Hager
Director, Maryland State Clearinghouse
for Intergovernmental Assistance

GWH/ cw

TELEPHONE: 301-383-7875
OFFICE OF STATE CLEARINGHOUSE

HARRY HUGHES
GOVERNOR

MARYLAND
DEPARTMENT OF STATE PLANNING
301 W. PRESTON STREET
BALTIMORE, MARYLAND 21201-2365

CONSTANCE LIEDER
SECRETARY

June 18, 1984

Mr. William E. Trieschman, Jr.
Chief, Planning Division
Department of Army
Balto. District Corps of Engineers
P. O. Box 1715
Baltimore, Md., 21203

SUBJECT: REVIEW AND RECOMMENDATION

State Identification Number: MD 84-4-507

Applicant: Corps of Engineers, Dept. of Army

Location: Chesapeake Bay Area

Recommendation: Endorsement with Comments

Dear Mr. Trieschman:

The State Clearinghouse has coordinated the intergovernmental review of the referenced subject. Acting under Article 88C of the Annotated Code of Maryland and Code of Maryland Regulations 16.02.03, the State Clearinghouse received the following comments:

Tri-County Council for Southern Md., Calvert County, Cecil County, Dorchester County, Kent County, St. Mary's County, Talbot County, Regional Planning Council and its member jurisdictions, Dept. of Transportation, Dept. of Economic and Community Development, including their Maryland Historical Trust section, Dept. of Agriculture, Office of Environmental Programs, and the Department of State Planning stated that the subject is consistent with their plans, programs and objectives as of this date.

Maryland Dept. of Transportation noted (copy attached) that the following items needed clarification or verification:

- Page 40, Table 7; Reference is made to the Choptank River (to Denton) and listed with an authorized depth of 8 ft. The Department noted that the federal authorized channel depth up to Choptank River to their facility at Cambridge, Maryland is 25 ft. (12 ft. at Denton).

- Page 41, Second Par.; Listed as a significant navigation and waterborne commerce problem is A need to minimize erosion damage from waves used by passing vessels. The Department noted that this item has appeared many times during the past decade without adequate justification and they are not aware of this as a serious problem.

- Summary Report, Supplement A Page A-91; The statement that container ships will probably not increase in size is not true as these ships that are already under construction are larger than those employed the past 10 years.

TELEPHONE: 301-383-7875
OFFICE OF STATE CLEARINGHOUSE

- Page 92, Figure A12; The portion of the chart pertaining to coal exports from the Port of Baltimore is in error.

Page A94 2nd Par.; Cove Point LNG terminal is closed and the likelihood of any petroleum refinery development in the State of Maryland is remote.

Regional Planning Council advised (copy attached) that the following comments are being forwarded at this time with more detailed comments to be submitted at a later date:

- The Regional Planning Council noted that public involvement has been minimal even though the report states that this is a key element of the process. The Council feels that local and regional planning agencies be more involved than in the past.

- The Council noted that the report is very narrow, focusing on only two issues. Existing and Future Conditions. They felt that both of these analyses are superficial and did not reveal any new information.

- The Planning Council noted that coordination with the EPA Bay Program was minimal with the Corps basically noting the results, but not connecting them with their study. The Council suggested a more comprehensive evaluation of the data and an extensive public review of the entire document and major revisions before the report is published.

Department of Natural Resources and the University of Maryland Center for Environmental and Estuarine Studies have not responded as of this date; however, if comments are received they will be forwarded.

Department of State Planning noted that the demographic, land use, economic and related information utilized as the basis for projecting needs and future conditions are outdated. They felt that the projections used are much higher than current projections of population, employment, etc. They indicated that more recent land use data, recreation inventory and other needs data could be secured from the Department of State Planning and other state agencies. The Department further noted that while the study documents these shortcomings, it should be emphasized that the basic data is not current.

As a result of the review, it has been determined that the subject is consistent with Maryland plans, programs and objectives as of this date. The State process recommendation is endorsement with comments.

We appreciate the opportunity to formally comment on this study and look forward to cooperatively working together to achieve the objectives of the study.

Sincerely,

Guy W. Hager
Director, State Clearinghouse for
Intergovernmental Assistance

GWH:mmk

cc: Bruce Gilmore, Clyde Pyers, Lowell Frederick, Max Eisenberg, Will Horst, Scrib Sheafor, Dennis Taylor, Wayne Cawley, Michael Pugh, Kristen Hughes, Frank Jaklitsch, Wayne Gardner (84-092), Anthony Redman, Linda Webb, Edward Cox, Charles Massey

Director
Maryland State Clearinghouse
for Intergovernmental Assistance
301 West Preston Street
Baltimore, MD 21201-2365

Date: 5/7/84
(84-282)

RECEIVED
MAY 10 1984

SUBJECT: REVIEW COMMENT AND RECOMMENDATION

State Identification Number: MD 84-4-507

Applicant: Corps of Engineers, Dept. of Army

Description: Chesapeake Bay Study

Responses must be returned to the State Clearinghouse on or before 5/3/84.

Based on a review of the notification information provided, we have determined that:

Check One:

____ 1) It is consistent with our plans, programs, and objectives (and when applicable, with the Coastal Zone Management Program and Historic Preservation Standards).

XXX 2) It is generally consistent with our plans, programs, and objectives, but the qualifying comment below is submitted for consideration.

____ 3) It raises problems concerning compatibility with our plans, programs, or objectives, or it may duplicate existing program activities, as indicated in the comment below. If a meeting with the applicant is requested, please check here ____.

____ 4) Additional information is required to complete the review. The information needed is identified below. If an extension of the review period is requested, please check here ____.

____ 5) It does not require our comments.

COMMENTS: Items in several sections needing clarification or verification are as follows: Summary Report: Pages 39-41, (1) Page #40, Table 7
Reference is made to the Choptank River (to Denton) and listed with an authorized
(Additional comments may be placed on the back or on separate sheets of paper)

(see Attached)

Signature: [signature]

Name: Clyde E. Pyers, Director
Off. of Transportation Planning

Organization: MDOT

Address: P.O. Box 8755 - BWI Airport
MD 21240-0755

(84-282)

State Identification Number: MD 84-4-507

Applicant: Corps of Engineers, Dept. of Army

Description: Chesapeake Bay Study

depth of 8 ft. Specifically related to transportation matters, the federal authorized Channel depth up to Choptank River to our facility at Cambridge, Maryland is 25 feet (and 12 feet at Denton.)

(2) p. 41, second paragraph

Listed as a significant navigation and waterborne commerce problem is "A need to minimize erosion damage from waves used by passing vessels". This item has surfaced many times during the past decade without adequate justification. If there is a serious problem, then we are totally aware of the magnitude of same.

Summary Report, Supplement A:
Page A-91, 3rd paragraph

The statement that container ships will probably not increase in size simply is not true. As we submit these comments, container ships are already under construction which are significantly larger than those employed 10 years ago.

Page A-92, figure A-12

The portion of this chart pertaining to coal exports from the Port of Baltimore is grossly in error.

Page A-94, 2nd paragraph

Cove Point LNG terminal is closed and the likelihood of any petroleum refinery development in the State of Maryland is remote.

Tidal Flooding Study Appendix D
Page D-7, first paragraph

The statement referring to the "existing State dredged channel" is somewhat misleading, since this is a federally authorized channel and has been for quite some time.

For more information please contact Mr.Louis Willett, Maryland Port Administration, at (301) 659-4794.

Regional Planning Council
2225 North Charles Street Baltimore, Maryland 21218-5767 (301) 383-5838
J. Hugh Nichols, Chairman Walter J. Kowalczyk, Jr., Executive Director

Date: April 27, 1984

Department of State Planning
301 W. Preston Street
Baltimore, Marylnd 21201

RE: Metropolitan Clearinghouse Review and Referral Memorandum, Project: 84-092 Chesapeake Bay Study

State Clearinghouse # 84-4-507

Dear Mr. Hager:

The attached review and referral memorandum is certification that the above referenced project has undergone review and comment by the Regional Planning Council and a recommended action has been determined based on the Council's findings.

Comments on this project were requested from: Anne Arundel County, Baltimore City, Baltimore County, Harford County.

Comments from the following jurisdictions are included with the Clearinghouse review: Baltimore City, Baltimore County.

We appreciate your attention to Metropolitan Clearinghouse procedures. If you have any questions, please contact us at 383-7110.

Sincerely,

W. Wilson Horst, Coordinator
Metropolitan Clearinghouse

Attachment

FROM: Mr. Larry Reich, Director
Dept. of Planning
222 E. Saratoga Street
Baltimore, Maryland 21202

DATE: April 9, 1984

R P C Meeting: April 27, 1984

☐ Joint RPC/CHHSA Review Cycle (up to 60 days)

SUBJECT: REFERRAL COORDINATOR REVIEW SUMMARY

~~Applicant~~ Referral Source: Department of State Planning

Project: Chesapeake Bay Study

R & R File Number: 84-092

Comments should be returned by: 4/18/84

This project has been forwarded to the following local departments or agencies (Check appropriate blanks and attach comments from the reviewing agencies):

✓ Planning ___ Public Works

___ Environmental Protection ___ Human Relations

___ Others (Specify) ______________________

JURISDICTION'S COMMENTS

Check One

___ This jurisdiction has no comments on this proposal.

✓ This project is consistent with or contributes to the fulfillment of local comprehensive plans, goals and objectives.

___ This project raises problems concerning compatibility with local plans, or intergovernmental, environmental or civil rights issues and a meeting with the applicant is requested.

___ This project raises problems concerning compatibility with local plans, or intergovernmental, environmental or civil rights issues; however, a meeting with the applicant is not requested.

___ This project is generally consistent with local plans, but qualifying comments are necessary (attach comments).

RETURN TO:

Coordinator, Metropolitan Clearinghouse
Regional Planning Council
2225 North Charles Street
Baltimore, Maryland 21218

Signature L Reich
Title ____
Agency ____
Date ____

TO: Mr. Larry Reich, Director
Department of Planning
222 E. Saratoga Street
Baltimore, Maryland 21202

Date: April 9, 1984

SUBJECT: PROJECT REVIEW FORM

~~Applicant~~ Referral Source: Department of State Planning

Project: Chesapeake Bay Study

R&R File Number: 84-092

Comments should be returned by: 4/18/84

Check One

___ This agency has no comments on this proposal.

✓ This project is consistent with or contributes to the fulfillment of local comprehensive plans, goals and objectives.

___ This project raises issues concerning compatibility with local plans or intergovernmental problems and a meeting with the applicant is requested. (Explain below)

___ This project raises issues concerning compatibility with local plans or intergovernmental problems; however, a meeting with the applicant is not requested. (Explain below)

___ This project is generally consistent with local plans, but qualifying comments are necessary. (Explain below)

Comments ______________________

RETURN TO LOCAL REFERRAL COORDINATOR NAMED ABOVE

Signature [signature]
Title CHIEF
Agency BALT CITY, PLANNING

FROM: Mr. James Hoswell
Office of Planning & Zoning
County Courts Building
401 Bosley Avenue
Towson, Maryland 21204

DATE: April 9, 1984

R P C Meeting: April 27, 1984

☐ Joint RPC/CHHSA Review Cycle (up to 60 days)

SUBJECT: REFERRAL COORDINATOR REVIEW SUMMARY

~~Applicant~~ Referral Source: Department of State Planning

Project: Chesapeake Bay Study

R & R File Number: 84-092

Comments should be returned by: 4/18/84

This project has been forwarded to the following local departments or agencies (Check appropriate blanks and attach comments from the reviewing agencies):

___Planning ___Public Works

___Environmental Protection ___Human Relations

___Others (Specify)______________

JURISDICTION'S COMMENTS

Check One

___This jurisdiction has no comments on this proposal.

✓ This project is consistent with or contributes to the fulfillment of local comprehensive plans, goals and objectives.

___This project raises problems concerning compatibility with local plans, or intergovernmental, environmental or civil rights issues and a meeting with the applicant is requested.

___This project raises problems concerning compatibility with local plans, or intergovernmental, environmental or civil rights issues; however, a meeting with the applicant is not requested.

___This project is generally consistent with local plans, but qualifying comments are necessary (attach comments).

RETURN TO:

Coordinator, Metropolitan Clearinghouse
Regional Planning Council
2225 North Charles Street
Baltimore, Maryland 21218

Signature Wm Freeman
Title Asst to the County Adm Officer
Agency County Adm Office
Date 4/11

TO: Mr. James Hoswell
Office of Planning & Zoning
County Courts Building
401 Bosley Avenue
Towson, Maryland 21204

Date: April 9, 1984

SUBJECT: PROJECT REVIEW FORM

~~Applicant~~ Referral Source: Department of State Planning

Project: Chesapeake Bay Study

R&R File Number: 84-092

Comments should be returned by: 4/18/84

Check One

___This agency has no comments on this proposal.

✓ This project is consistent with or contributes to the fulfillment of local comprehensive plans, goals and objectives.

___This project raises issues concerning compatibility with local plans or intergovernmental problems and a meeting with the applicant is requested. (Explain below)

___This project raises issues concerning compatibility with local plans or intergovernmental problems; however, a meeting with the applicant is not requested. (Explain below)

___This project is generally consistent with local plans, but qualifying comments are necessary. (Explain below)

Comments______________

RETURN TO LOCAL REFERRAL COORDINATOR NAMED ABOVE

Signature [illegible]
Title Director
Agency Office of Planning and Zoning

REGIONAL PLANNING COUNCIL
2225 North Charles Street
Baltimore, Maryland 21218

RPC Meeting April 27, 1984

REVIEW AND REFERRAL MEMORANDUM

Project: 84-092

Chesapeake Bay Study. The Baltimore District Corps of Engineers, Department of the Army, has prepared a Summary Report Draft "Chesapeake Bay Study." This is the third phase of a study initiated in 1967, at which time 3 major study objectives were defined and subsequently reported. In this third phase report the most pressing Bay problems have been defined and preliminary solutions formulated. The two most pressing problems receiving attention are: (1) tidal flooding along the Chesapeake Bay shorelines; (2) low freshwater inflow to the Bay. The Hydraulic Model developed in earlier stages of work was used in analysis of these problems.

Referral Source: Department of State Planning

COMMENT

More detailed comments will be submitted to the U.S. Corps of Engineers after review of supplements to this "Summary" report. In the meantime, the following comments are offered following review of the material at hand.

Although this study states that public involvement was a key element of the process, that has not been the case. The Citizens Program for the Chesapeake Bay (CPCB) was involved only briefly 10 years ago in reviewing a draft of the Future Conditions Report. At no time were local or regional planning agencies in the Baltimore area given more than a brief printed status report and final documents.

The scope of the report is very narrow, focusing on only two issues. Overall information on the Bay is limited to the two earlier reports, Existing and Future Conditions. Both these analyses are superficial and did not reveal any new information. Problems, such as "obnoxious weeds" cited in earlier reports are dismissed as no longer a problem, without an analysis of the reason.

Coordination with the EPA Bay Program was minimal, with the Corps basically noting the results, but not connecting them with their own study. We suggest a more comprehensive evaluation of the data and an extensive public review of the entire document and major revisions before the report is published.

Recommendation: ENDORSEMENT IS RECOMMENDED SUBJECT TO THE ABOVE COMMENTS.

REGIONAL PLANNING COUNCIL
2225 North Charles Street
Baltimore, Maryland 21218

RPC Meeting April 27, 1984

REVIEW AND REFERRAL MEMORANDUM

I HEREBY CERTIFY that at its 235th meeting, held April 27, 1984 the Regional Planning Council concurred in this Review and Referral Memorandum and incorporated it into the minutes of that meeting.

April 27, 1984
DATE

WALTER J. KOWALCZYK, JR.
Walter Kowalczyk
Executive Director

MARYLAND
DEPARTMENT OF STATE PLANNING
301 W. PRESTON STREET
BALTIMORE, MARYLAND 21201-2365

HARRY HUGHES
GOVERNOR

CONSTANCE LIEDER
SECRETARY

May 14, 1984

Mr. William E. Trieschman, Jr.
Chief, Planning Division
Department of Army
Baltimore District Corps of Engineers
P.O. Box 1715
Baltimore, Maryland 21203

RE: State Clearinghouse Project MD84-4-507, Chesapeake Bay Study

Dear Mr. Trieschman:

This is to inform you that the reply date noted in our April 6th correspondence cannot be met due to several requests for more time to submit reviews.

The Clearinghouse will make every effort to complete the review of the reference project during the weekof May 21st.

Your cooperation concerning this matter is appreciated.

Sincerely,

Guy W. Hager, Director
Maryland State Clearinghouse
for Intergovernmental Assistance

GWH:cs

TELEPHONE 301 383 7700
TTY for Deaf 301 383 7555
OFFICE OF SECRETARY

Regional Planning Council
2225 North Charles Street Baltimore, Maryland 21218-5767 (301) 383-5838
J. Hugh Nichols, *Chairman* Walter J. Kowalczyk, Jr., *Executive Director*

May 7, 1984

William E. Trieschman, Jr.
Chief, Planning Division
Department of the Army
Baltimore District, Corps of Engineers
P.O. Box 1715
Baltimore, Maryland 21203

MD 84-4-507

Dear Mr. Trieschman:

We have recieved your letter of April 30, 1984 regarding transmission of the 17-volume draft final report on The Chesapeake Bay Study per our request and look forward to receiving the reports.

We will forward any comments arising from review of this material through Guy Hager, Director of the State Clearinghouse for Intergovernmental Assistance.

Thank you for your cooperation in this matter.

Sincerely yours,

W. Wilson Horst, Coordinator
Metropolitan Clearinghouse

cc: G. Hager
A. Gwynn

Baltimore City Anne Arundel County Baltimore County Carroll County Harford County Howard County State of Maryland

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 1715
BALTIMORE, MARYLAND 21203

April 30, 1984

REPLY TO ATTENTION OF

Planning Division

Mr. Wilson Horst
Regional Planning Council
2225 North Charles Street
Baltimore, Maryland 21218

Dear Mr. Horst:

As requested in your telephone conversation of April 26th with Mr. Ted Robinson, of my staff, I am sending you, under separate cover, the remaining 17 volumes of the draft final report on the Chesapeake Bay Study. The report is divided into a summary of the entire study and specific reports on both the Low Freshwater Inflow and Tidal Flooding Studies. A chart showing the organization of the entire 18-volume report is enclosed for your information. It should be noted that the Map Folio (Appendix F to the Low Freshwater Inflow Report) will be printed twice the size in the final report.

Any comments you may have should be sent to the Director of the Maryland State Clearinghouse for Intergovernmental Assistance to be incorporated with the official state comments. Should you have any questions concerning the report, please call Mr. Robinson at 962-4710.

Sincerely,

William E. Trieschman, Jr.
Chief, Planning Division

Enclosures

-1715

July 17, 1984

Planning Division

Mr. Guy W. Hager
Director
State Clearinghouse for
Intergovernmental Assistance
Maryland Department of State Planning
301 West Preston Street
Baltimore, Maryland 21201-2365

Dear Mr. Hager:

Thank you for your letter of June 18, 1984 transmitting Maryland's comments on the Chesapeake Bay Study draft report. As suggested by Mr. Sam Baker, during his July 11th telephone conversation with Mr. A. E. (Ted) Robinson, we are enclosing a paper addressing each of the comments.

Should you have any questions regarding this matter, please call Mr. Robinson at 962-4710.

Sincerely,

William E. Trieschman, Jr.
Chief, Planning Division

Enclosure

ROBINSON/pk/24710/NABPL-C

NELSON/NABPL

TRIESCHMAN/NABPL

Accommodation of State of Maryland's
Comments on the Chesapeake Bay Study

In general, a number of the comments are on the summary of the findings of the Future Conditions Report. Because this report was prepared in the mid-1970's time period, much of the information has become dated. However, it was not possible to revise most of these findings within the authority and funding available to us. In fact, we have recommended that the appropriate agency do a thorough update of the Future Conditions Report. For our final report, we will reflect EPA's latest findings in the section on water quality. We will also re-emphasize the origination date of information in the Future Conditions Report.

Maryland Department of Transportation

Page 41: This was a finding of the Future Conditions Report. Its primary reference was to the C&D Canal approaches where ship wakes were a reported shore erosion concern.

Page 92: The coal export projections for the Port of Baltimore are based on commodity trend analyses done as part of the FCR. As previously noted, we are recommending that the appropriate agency update all projections contained in the Future Conditions Report.

Page 40 and Supplement A, Pages A-91 and A-94: These sections of the report have been revised to reflect your comments.

Regional Planning Council

We have noted the Regional Planning Council's comments on public participation and agree that public input at all levels is important. We have, therefore, emphasized this throughout the study. All work was closely coordinated with the people designated by the Governors of the involved states and the heads of Federal agencies for participation on the Advisory Group, Steering Committee, and Task Groups. Public meetings and workshops were held at appropriate times during the study, newsletters and informational brochures were distributed to thousands of people, all reports including the final report have been reviewed by a variety of agencies, councils, commissions, and lay persons, hundreds of presentations were made to groups of all types, and a Citizens Advisory Committee participated in the identification of the problems and the formulation of the study focus. In addition, over 150,000 persons were informed about the study through the tour program at the Chesapeake Bay Model. We are convinced that this public participation program has been an intensive one and has been conducted at a level consistent with the types of investigations done in the various phases of the study, the types of recommendations being made, and the recent revisions in scope dictated by available funding.

We have closely followed the progress of the EPA Chesapeake Bay Program through the participation of EPA on our Advisory Group and Steering Committee. We should note that the reports on the EPA program were not available at the time the majority of work on our study was being done. We therefore were not able to display its findings in much detail. However, we will expand our discussions of these findings in our final report. But, connection of the results with our study beyond the level already done is not only inconsistent with the stated scope and objectives of our study, but, in some cases, beyond that which is possible with the present state of the art knowledge of Chesapeake Bay processes. The nutrient budget is an example of this. On the other hand, we are hopeful that the continuing EPA program will fully consider all aspects of freshwater inflow to Chesapeake Bay and will provide for an adequate public review of its findings.

Department of State Planning

We have noted the Department's concerns about the outdated nature of much of the information presented in the Future Conditions Report. As noted above, we will more carefully clarify the nature of this information and will recommend that it be updated.

MARYLAND
DEPARTMENT OF STATE PLANNING
301 W. PRESTON STREET
BALTIMORE, MARYLAND 21201-2365

HARRY HUGHES
GOVERNOR

CONSTANCE LIEDER
SECRETARY

July 25, 1984

MEMORANDUM

TO: Addressees

FROM: Guy W. Hager
Director, State Clearingnouse for
Intergovernmental Assistance

SUBJECT: State Clearinghouse Project #MD 84-4-507
Chesapeake Bay Study

Enclosed for your information is the reply to comments submitted by your agency and included in the June 18, 1984 Clearinghouse closeout review letter. If your agency requests any further information regarding these comments, please contact the Corps of Engineers, Department of the Army, directly and send a copy of any correspondence to the State Clearinghouse.

Your attention to this matter is appreciated.

GWH/cw

Enclosure

Addressees:

DECD - Frederick
DNR - Gilmore
MDOT - Pyers
OEP - Eisenberg
RPC - Horst (4 copies)
TCCSMD - Hodge
DOA - Cawley
CEES - Taylor
COMP - Smith
Cecil Co. - Pugh

Kent Co. - Hughes
Calvert Co. - Jaklitsch
Q.A. Co. - Gardner
Talbot Co. - Redman
Dorchester Co. - Nabb
Somerset Co. - Massey
St. Mary's - Cox

Information Copy:

William E. Trieschman, Jr.

TELEPHONE 301-383-7875
OFFICE OF STATE CLEARINGHOUSE

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
P. O. Box 1467
Harrisburg, Pennsylvania 17120

May 29, 1984

(717) 787-2869
Office of the Deputy Secretary
Resources Management

In reply refer to
RM-WR
F70:4B

William E. Trieschman, Jr., Chief
Planning Division
Baltimore District - Corps of Engineers
P. O. Box 1715
Baltimore, MD 21203

Dear Mr. Trieschman:

In response to your letter of March 27, 1984, the Department has reviewed the draft of the final report on the Chesapeake Bay Study. While the Commonwealth of Pennsylvania is not included in the study area for the Chesapeake Bay Study, Pennsylvania has participated in the Advisory Group and Steering Committee for the Chesapeake Bay Study during most of the period of study. Our Department has particularly been interested in the Low Freshwater Inflow portion of the study, which investigate ' the possibility of utilizing existing and potential storage reservoirs in Pennsylvania and elsewhere for combating higher Chesapeake Bay salinities.

The draft of the final report has been reviewed by the Department's Bureaus of Water Resources Management, Soil and Water Conservation, and Water Quality Management. This letter incorporates the comments of these Bureaus into a single response for the Department.

In view of the recent completion of EPA's "Chesapeake Bay Program" study the Corps' "Chesapeake Bay Study" *report should clearly explain the relationship* between these two major Federal efforts. We suggest that this be done up front in the Summary Report. The Cheaspeake Bay Program is referred to on page 8 of the Summary Report only rather incidentally as "One other important study...". We think the clarification is justified in view of the fact that one of the objectives of the Corps' study was "to assess the existing physical, chemical, biological, economic and environmental conditions of the Chesapeake Bay." Except perhaps for the economics part, this is exactly what the EPA program did at a cost of about $30 million compared to about $15 million for the Corps' study.

The Corps suggests later in the report that the EPA program provided water quality input to its study, but it appears that the information used was very general, the discussion shallow and, in some cases, confusing. Supplement A of the Summary Report, page A-84, for example, says that "...the water quality of the Bay itself is good with most of the severe problems occurring in the tributaries..." and "...the water quality problems which currently plague Bay waters can be expected to continue to cause problems". These statements not only sound contradictory, but lack *a real description of the problems* contained in the EPA program report. Figure A-10 and the discussion that follows in the report do

not explain the problems adequately and even seem to diminish their importance. We believe the report, in its present form, would cast a real question of credibility on Federal and state participation in both efforts. We suggest that the Corps *solicit EPA assistance to beef up these and other portions of the report which deal* with water quality to put the problems in proper perspective. If this is not done, we believe the states will have a difficult time maintaining public support in cleaning up the Chesapeake Bay which is just now starting to generate fully.

Pennsylvania presently is developing a nonpoint management strategy to address nutrient and sediment loadings to the Bay, particularly with regard to agricultural activities. With one-third of the Bay region involved in agricultural land use activities, it seems appropriate to promote additional land protection measures for these areas. The State Conservation Commission, through the PL-566 Small Watershed Protection Program, is promoting such nonstructural protection measures to reduce soil erosion and nutrient losses to Bay tributaries. These protection measures involve Best Management Practices on agricultural lands.

In addition to improving water quality, these practices will result in more natural surface and groundwater conditions. By promoting natural hydroperiods, these land protection measures provide another alternative to improving flow supplementation to the Bay.

The Low Freshwater Inflow Study tested the effects of long-term drought events and increasing consumptive uses on Chesapeake Bay salinity, and these salinity impacts were translated into habitat changes and ultimately to impacts on critical Bay species. Study findings demonstrated that existing and potential basin storage, including the Susquehanna River Basin within Pennsylvania, was of insufficient magnitude to control salinity during a drought of record occurrence such as that which occurred during the drought of the early 1960's. However, the study indicated that potential quantities of storage could be made available or developed for mitigating the impacts of future incremental consumptive uses particularly during summer and fall periods. The Department takes exception to both the high consumptive use projections used in the Chesapeake Bay Study, and *the contention that large amounts of storage within the Basin can be made available* for flow augmentation to combat higher Chesapeake Bay salinities.

Table 25 on page 100 of the Summary Report indicates that between 710,000 and 1,270,000 acre-feet of flow augmentation storage would be needed in the Susquehanna River Basin to mitigate the impacts of future incremental consumptive uses during summer and fall periods. Currently, under 600,000 acre-feet of conservation storage exists in six reservoir projects within the Pennsylvania portion of the Susquehanna River Basin. Over 85% of this storage is located in the Raystown Lake Project. On page 94 of the Summary Report you have indicated that 20% of the existing conservation storage could be reallocated (120,000 acre-feet). Therefore, between 590,000 and 1,150,000 acre-feet of new flow augmentation storage would need to be developed within the Susquehanna River Basin in order to implement the summer and multi-seasonal plan which you have indicated on page 100 of the Summary Report. The Department fully recognizes the difficulty of developing major new reservoir sites within the Commonwealth. High interest rates, increased construction costs, and environmental and social constraints have all combined to virtually preclude the development of large reservoirs even where the need is urgent. We feel that it is unrealistic to consider

alternative plans for the Chesapeake Bay Study which require high levels of flow augmentation and correspondingly large amounts of upstream reservoir storage.

It has been our observation that the same economic conditions which currently preclude large reservoir development, also have significantly slowed the increase in consumptive use. Our State Water Plan consumptive use projections, which are lower than those used in the Chesapeake Bay Study, show a growth in consumptive use in the Pennsylvania portion of the Susquehanna River Basin from 373 million gallons per day (mgd) in 1980 to 529 mgd in 1990, an increase of 156 mgd. On page 97 of the Summary Report, incremental consumptive losses through the year 2020 are projected to be 992 mgd for the Susquehanna River Basin. Over 76 percent of the Susquehanna River Basin drainage is within Pennsylvania. Therefore, a considerable discrepancy exists between the Pennsylvania State Water Plan and Chesapeake Bay Study consumptive use projections. Most of the Susquehanna River Basin's consumptive use increase is expected in the power generation and agricultural irrigation sectors. Recent power generation water requirement projections received from the Electric Utility Companies of Pennsylvania indicate lower forecasts for the future than the State Water Plan projections had originally indicated. Similar trends are occurring in the manufacturing and mineral industry sectors. By way of comparison, Figure 14 on page 48 of the Summary Report projects a 12-fold increase in Chesapeake Bay Region power plant consumptive use requirements. While this Region includes areas other than Pennsylvania's Susquehanna River Basin, we feel a significant discrepancy exists. For these reasons we would strongly question future flow requirements and flow augmentation based on year 2020 consumptive use increases amounting to 2,480 mgd for the Chesapeake Bay drainage.

The Department's State Water Plan reports for the Susquehanna River Basin indicate the Commonwealth's willingness to fulfill the Susquehanna River Basin Commission's regulation to make up from storage all additional incremental consumptive uses within the Susquehanna River Basin whenever flows drop below the 7-day, 10-year frequency low flow trigger level. We feel existing and planned modifications to existing reservoir storage facilities within the Commonwealth are adequate to provide these storage requirements. However, to make up for additional consumptive uses throughout the Chesapeake Bay drainage on a frequent multi-seasonal basis is asking too much of existing reservoir storage facilities within the Commonwealth of Pennsylvania.

In our review of the Biota Evaluation Panel's findings and recommendations for the Chesapeake Bay Study, we did not get the impression that the panel felt salinity control in the Bay, through extensive streamflow augmentation, was desirable or recommended. Their recommendation No. 3 states that "a highly conservative policy toward alteration of freshwater inflow should be pursued in view of the high biological value of the Chesapeake, the indications of important detrimental effects and the limits on predictive capability". Their recommendations further state that it should be recognized that flow modification and resultant effects are site specific and time specific, as well as accumulative and require individual evaluation.

In summary, we are quite concerned about the direction the Chesapeake Bay Study has recently taken. To consider alternative plans which call for substantial streamflow augmentation to control salinity for specific Chesapeake Bay

species without knowing the full consequences of these actions on the remainder of the species is not prudent, environmentally acceptable or cost effective. In addition, the adverse impacts of developing and implementing substantial amounts of additional upstream storage must be considered. We, therefore, request that the Baltimore District-Corps of Engineers reevaluate their findings and redefine their multi-seasonal plan to include more realistic alternatives which are more conservative and allow for uncertainties in biological prediction.

We sincerely hope these comments will be helpful to you in further assessing and developing your alternative plans for the Chesapeake Bay Study. If there are questions concerning our comments, please feel free to contact Steve Runkle of our State Water Plan Division at 717-787-5008.

Sincerely,

Patrick J. Solano
Deputy Secretary
for Resurces Management

July 26, 1984

Planning Division

Mr. Patrick J. Solano
Deputy Secretary for Resources Management
Department of Environmental Resources
Commonwealth of Pennsylvania
Harrisburg, Pennsylvania 17120

Dear Mr. Solano:

Thank you very much for your letter dated May 29, 1984 commenting on the Chesapeake Bay Study draft report. We have found these comments most useful in the editing of this report.

As you have noted in your letter, the discussion of water quality in Supplement A is indeed somewhat confusing in the light of the EPA's recent findings. The information contained in Supplement A is a summary of the Future Conditions Report prepared in 1978. It reflects the EPA's assessment of the condition of Chesapeake Bay in the mid-seventies. In order to avoid any further confusion, this section will be clarified in the context of the EPA's most recent Chesapeake Bay water quality assessments.

Again, the consumptive loss projections used in the Low Freshwater Inflow Study were calculated in the late 1970's. These projections were based on the then most current Series E OBERS Economic and Demographic projections and specific projections of electrical power demand and resulting consumptive losses furnished to this office by the Susquehanna River Basin Commission. The OBERS 1980, as well as the revised losses due to electrical power generation were not available, unfortunately, until after the completion of the hydraulic model testing program. Because of this, we were unable to include them in our base data set. We are well aware, however, that they appear to be somewhat less optimistic than the projections available for use in 1977, and that there is a possibility that the projections used in our work may not be realized until sometime after the year 2020. This has been fully addressed in the "Sensitivity" section of the report. To alleviate any confusion, the following paragraph has been added to the conclusions found in both the Summary Report and the Low Freshwater Inflow Study Main Report:

"It is realized that demographic and economic projections more recent than those used in this study indicate that the magnitude of consumptive losses used as the bases for the foregoing analyses may not be realized in the year 2020. It is believed, however, that under any circumstances, the magnitude of increases in consumptive losses will be sufficient to be of real concern and that this Low Freshwater Inflow Study provides a framework for the development of corrective actions."

Further, the time frame within which the Future Conditions Report was completed will be emphasized where necessary in the Chesapeake Bay Study Report.

We recognize your concerns over the quantities of storage required to "make up for" consumptive losses, and have carefully framed the report so as to avoid the impression that we are recommending the construction of reservoirs. Reservoir storage, however, is one potential solution and we believe it should be retained for future consideration. In order to clarify our position, we have added to the Summary Report, the Main Report on Low Freshwater Inflow, and the Plan Formulation Appendix the statement shown on the enclosed pages.

We have discussed this matter with Mr. Steve Sunkle and trust that these revisions respond to your concerns. If there are any further comments or questions concerning this matter, please do not hesitate to call this office.

Sincerely,

William E. Trieschman, Jr.
Chief, Planning Division

Enclosure

MCKAY/pk/24710/NABPL-C
ROBINSON/NABPL-C
NELSON/NABPL
TRIESCHMAN/NABPL

Supplementing low freshwater inflow into Chesapeake Bay from reservoir storage will produce substantial benefits in the Estuary. However, it must be emphasized that no recommendations are being made for the immediate implementation of any alternatives addressed in this study. Rather, considerable further analysis of each measure identified for coping with the effects of low freshwater inflow must be completed before any recommendations for action can be made. In particular, upstream socio-economic as well as environmental impacts must be identified in detail to determine that the total benefits involved with any alternative would outweigh the total costs, including the use of reservoir storage. A further important ingredient in these studies will be the delineation of the local, regional, and national perspectives arising in the consideration of the various alternatives.

Another point that will be emphasized is the meaning of the word "reasonable" as it relates to quantities of storage. This determination is based solely on technical considerations and experience in previous studies. For the most part, it is a function of the amount of water that can be stored without materially affecting the natural variability of flows in the main stem of the rivers. The work associated with this study appears to indicate that the storage of a quantity of water equivalent to the amount of consumptive losses that will accumulate in two seasons during a severe drought in the year 2020 is the outer limit of technically feasible "reasonable" storage. Certainly, more detailed studies are needed to ascertain if this level of storage can be economically, socially, and environmentally justified or if some lesser level of storage is more appropriate.

State of Delaware
Department of Natural Resources
& Environmental Control
89 Kings Highway
P.O. Box 1401
Dover, Delaware 19901

Office of the Secretary

Telephone (302) 736-4403

June 5, 1984

Mr. William E. Trieschman, Jr.
Chief, Planning Division
Department of the Army
Baltimore District, Corps of Engineers
P.O. Box 1715
Baltimore, Maryland 21203

Dear Mr. Trieschman:

The draft of the final report on the Chesapeake Bay Study has been reviewed by this Department. The report is extremely comprehensive in its scope and because the recommendations are based on a thorough review of the literature and extensive experimentation, we concur with those presented in the Draft Summary Report.

I am hopeful that this report, along with the recently completed Chesapeake Bay Report and subsequent legislation will lead to an improvement in the water quality of the Cheaspeake Bay and its tributaries.

Thank you for providing the material for our review. I look forward to receiving the final reports.

Sincerely,

John E. Wilson, III
Secretary

NO RESPONSE NECESSARY

TORREY C. BROWN, M.D.
SECRETARY

STATE OF MARYLAND
DEPARTMENT OF NATURAL RESOURCES
TAWES STATE OFFICE BUILDING
ANNAPOLIS 21401

JOHN R. GRIFFIN
DEPUTY SECRETARY

June 8, 1984

Mr. William E. Trieschman, Jr.
Chief, Planning Division
Corps of Engineers
Baltimore District
Post Office Box 1715
Baltimore, Maryland 21203

Dear Mr. Trieschman:

Thank you for forwarding copies of the draft final report on the Chesapeake Bay Study. Staff of the Department have reviewed the document and found it to be especially valuable in providing a consolidated and coherent perspective of the vast array of activities and investigations conducted in the Chesapeake Bay since 1967. The Corps of Engineers' Study is clearly the most authoritative and comprehensive compendium ever prepared on the Chesapeake region.

For your use, a few detailed comments are included on the attached sheet.

The Corps is to be congratulated on completion of this first truly holistic investigation of the Bay.

Sincerely,

Torrey C. Brown, M.D.

TCB/TCA/mr
Encl: Comments on Study

cc: Verna Harrison
Thomas Andrews

Telephone (301) 269-3041
TTY for Deaf - Annapolis 269-2609 D.C. Metro - 565-0450

Comments on the Corps of Engineers' Chesapeake Bay Study

General Comments

1) There is some redundancy in the general background text throughout the report. It was noted that some scientific points were missed due to the padding.

2) There were a number of comments regarding the map folio. It is assumed that the quality will improve with the proposed enlargement.

Specific Comments

1) In the Summary Report:

Page 9 - Under the estuary description it states that the Bay was formed about 100,000 years ago. The end of the Wisconsin Stage is approximately 18,000 years before the present.

15 - The description of estimated groundwater recharge may more correctly be 8.5 to 11 inches.

23 - In the last paragraph, substitute "swamps" for "bogs".

33 - On Table 5, under Federal Agencies, "Office of Chesapeake Bay" is mentioned but it is not clear under what agency.

49 - In the first paragraph, hydrilla should be mentioned as a problem plant.

2) In the Low Freshwater Inflow Main Report:

Page 113 - Under Findings and Recommendations, item 7 mentions previously unknown salinity patterns. It may need more explanation, particularly on how the "tongue" of freshwater may affect the sediment transport pattern.

3) Appendix D:

Plates D-23 through D-94 are upside down.

COMMENTS INCORPORATED AS NOTED

June 1984
Dept. of Natural Resources

CRC

June 20, 1984

Mr. Alfred E. Robinson, Jr.
Chief, Chesapeake Bay Study Group
Baltimore District, Corps of Engineers
P.O. Box 1715
Baltimore, MD 21203

Dear Ted:

I am returning four volumes of the Study with notes. Review is both a massive task and a difficult one, and I have not been complete.

I suggest that someone consider my notes in the following order, which I followed:

Appendix A
Appendix B
Main Report
Summary

Suggestions, like your writing, flow in that sequence. I have not always repeated them.

Congratulations on much fine work, good thinking and effective writing. There will be value for many decades.

What will be done with the Study's extensive literature collection? If there is danger that it will be disposed of, I offer to take it and distribute it usefully.

Cordially,

L. Eugene Cronin
Director

LEC:sw

Enclosures

Chesapeake Research Consortium, Incorporated
4800 Atwell Road
Shady Side, Maryland 20764
(301) 867-7392
from Washington
261-5978

The Johns Hopkins University
University of Maryland
Smithsonian Institution
Virginia Institute of Marine Science

DRAFT CHESAPEAKE BAY STUDY

General Comments - LEC - 19 June 1984

LOW FRESHWATER INFLOW STUDY
APPENDIX A
PROBLEM IDENTIFICATION

13 June 84

1. Simpler straight-forward prose would sometimes be an improvement. So would all possible reduction in redundancy.

2. It is not sufficiently clear that salinities are for surface only. OK for SAV, EAV, not for plankton, benthos or non-avian vertebrates.

3. p. 109 - on "potential habitat", "known habitat" and "true habitat" (my addition). This is exceptionally, even fundamentally, important, and should be re-written.

   The known habitat is within the potential habitat, and so, we think, is the true, but we know little about the % of the potential which is occupied by a species, except that it is highly variable over time (SAV's), season (crabs, fish, etc.) and by species. Some comments:

   Perhaps the most useful approach is to make clear reasonable statements showing that you are aware of these difficulties, state a working assumption - and go ahead. Perhaps the assumptions are:

   That the area of potential habitat will be increased or decreased by inflow alteration.

   That the area of utilized habitat will increase or decrease over time in proportion to the change in potential habitat.

   That, therefore, change in the potential habitat can be employed to approximate usefully the direction and magnitude of the area of used habitat after significant environmental alteration.

   These do not say that you can approximate the known, true or used habitat by knowing the potential habitat - apoint subject to serious criticism.

4. I know this is usual Corps format, but I wish for more attribution to sources, authors, etc.

5. I'm too chicken to comment on sections on economics and other tough parts.

LOW FRESHWATER INFLOW STUDY
APPENDIX B
PLAN FORMULATION

13 June 84

1. With necessarily limited review, I do not detect clear expression and analysis of the broad option of preventing, by law or regulation, further consumptive loss from the principal tributaries. This appears to be included under Conservation on p. B-3, but not clearly on B-41 or in Attachment B.I.

2. Sorry, but I haven't time for more thorough study.

LOW FRESHWATER INFLOW STUDY
MAIN REPORT

14 June 84

1. Comments on Problem Identification and, especially, Plan Formulation, might carry over to this Report.

2. I again wish that sources had been given.

3. The section on "THE BIOTA OF CHESAPEAKE BAY", pp. 34-43, is of special interest. Much is good, but some is inaccurate or imprecise. I haven't reviewed it in detail, and will only if requested. I suspect that I would suggest a number of small changes, but the general content and flow is good.

4. I am still very much concerned that Chapters IV, V and VI do not adequately address regulatory prohibition of extraction or seasonal contraints or similar prevention of extraction. I think this must be effectively considered.

CHESAPEAKE BAY STUDY
SUMMARY REPORT

1. This was seen last. I have made a few notes, but suggest that someone review my comments in Appendix A, Appendix B and the Main Report and carry forth into the Summary Report.

2. My strongest feelings are:

   Don't use measure, determine or other implications of precision when you mean estimate or approximate.

   Include regulatory prevention of extraction among the valid and preferred measures.

COMMENTS INCORPORATED AS NOTED

STATE OF DELAWARE
EXECUTIVE DEPARTMENT
OFFICE OF THE BUDGET
DOVER DELAWARE 19901

TELEPHONE (302) 736 4205

June 27, 1984

Mr. William E. Trieschman, Jr.
Chief, Planning Division
Department of the Army
P.O. Box 1715
Baltimore, MD 21203

Dear Mr. Trieschman:

RE: Chesapeake Bay Study

The Office of the Budget in its capacity as the State Clearinghouse (State Single Point of Contact) has reviewed the subject report and has no negative comments to offer. This report complies with federal, state and local regulations.

Sincerely,

Stephen T. Golding

Stephen T. Golding
State Budget Director

STG:FB:kg

cc: Ted Robinson

0855y

NO RESPONSE NECESSARY

SUSQUEHANNA RIVER BASIN COMMISSION
1721 North Front Street • Harrisburg, Pennsylvania 17102

From the Office of the Executive Director

June 28, 1984

Mr. William E. Trieschman, Jr.
Chief, Planning Division
Baltimore District, COE
P.O. Box 1715
Baltimore, Maryland 21203

Dear Bill:

SRBC staff has reviewed the draft of the final report on the Chesapeake Bay Study submitted with your letter of March 27, 1984. Our review focused primarily on the quantitative aspects of the Low Fresh Water Inflow portion of the study.

Several matters of concern have already been discussed directly with Mr. Robinson of your staff. Among these are the water use and consumptive loss projections which were apparently based on the National Water Assessment. Although the power generation water use projections were modified to reflect data which we had provided earlier, the overall increase in projected use (the greatest being in manufacturing usage) should be adequately qualified throughout the report. The report acknowledges slower growth rates than previously anticipated, thereby impacting the time frame within which water demands may occur. If nothing else, the perceived need for urgency of action is altered.

There is an apparent discrepancy in text reference to a five-fold increase in consumptive losses from 1965 to 2020, while Figure 18 of the report indicates a seven-fold increase. Through discussion with Mr. Robinson, it appears that the figure in question has been mislabeled.

Among alternative measures considered for mitigating impacts of reduced freshwater flows to the Chesapeake Bay was the reformulation of upstream reservoirs to provide flow augmentation storage. The discussion in this portion of the report was not clear although it deals in part, with the Susquehanna Basin. It appears that existing storage sites (regardless of purpose) and proposed sites shown as feasible in recent studies, were considered. However, reallocation of existing flood storage was

not considered, contrary to the current Cowanesque Reformulation Studies Program. The storage requirements to achieve even a slight enhancement of the base drought condition are very substantial and, with little question, are probably not attainable (estimates for the Susquehanna Basin ranging from 650,000 to 1,630,000 acre feet) without construction of one or more new storage reservoirs.

We question several points relative to the rather dramatic increase projected for consumptive water use (130 mgd in 1972 to 1170 mgd in 2020). The report cites this is due to increased power generation alone. Were this to be the case, it suggests the addition of about 40 power plants the size of the PP&L Susquehanna plant at Berwick by the year 2020.

The study recommendations will be carefully considered in formulating and implementing SRBC programs regarding water quantity and quality and effects on the Chesapeake Bay from Susquehanna River freshwater inflow.

Very truly yours,

Robert J. Bielo
Robert J. Bielo
Executive Director

COMMENTS INCORPORATED AS NOTED

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
Chesapeake Bay Program
839 BESTGATE ROAD
ANNAPOLIS, MARYLAND 21401

August 28, 1984

Mr. William Treischman
Chief, Planning Division
Baltimore District Corps of Engineers
P.O. Box 1715
Baltimore, Maryland 21201

Dear Mr. ~~Treischman~~ Bill:

Attached is our review of your recent draft report, "Chesapeake Bay Study: Low Freshwater Inflow Study." This appears to be a useful and informative report and we have already used some of your findings in our own work.

Thank you for the opportunity to review the draft document. We are looking forward to receiving the final report.

Sincerely,

Bill

William W. Horne, Director
Chesapeake Bay Liaison Office

Attachment

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
Chesapeake Bay Program
839 BESTGATE ROAD
ANNAPOLIS, MARYLAND 21401

301-224-2740
FTS-922-3752

DATE : August 21, 1984

SUBJECT: Review of Corps of Engineers Report

FROM : Gail Mackiernan, Environmental Scien tist
Chesapeake Bay Program, 3CB00

TO : William W. Horne, Director
Chesapeake Bay Program, 3CB00

I have recently reviewed the draft report, "Chesapeake Bay Study: Low Freshwater Inflow Study." This is a multi-volume document, so by necessity my review is somewhat limited in scope.

The study seeks to determine what impacts could be expected if freshwater inflow to Chesapeake Bay were reduced by drought, by consumptive loss, or a combination of the two. Ecological, hydrological, and socio-economic impacts were addressed. The Chesapeake Bay Study itself involved a number of groups, including citizens, scientific community, managers, government, and defense interests. The description of the organization and management of the study is interesting and could provide insight into potential CBP options.

Tests were conducted on the Chesapeake Bay hydraulic model at Matapeake to determine changes in salinity caused by reduced freshwater inflows. Four conditions were simulated:

a. Base Average - long term average inflow;

b. Future Average - base average flows reduced by consumptive losses predicted by year 2020;

c. Base Drought - recreation of historical inflows occurring in years 1963 - 1966;

d. Future Drought - base drought inflows reduced by 2020 consumptive losses (the "worst case").

Ecological impacts were based on habitat alterations for representative Bay organisms, which included ecologically, economically, or recreationally important species. These ranged from phytoplankton to waterfowl. Economic impacts were estimated based on changes to commerical fisheries, shipping, and industrial users of water, as well as to recreationally - based industries such as sport fishing, boating, swimming, operation of marinas, hunting, and tourism. Potential social impacts included subtle effects such as changes of traditional ways of life due to alteration in shellfish or finfish populations.

Finally, strategies to mitigate or reduce magnitude of these impacts were evaluated. These measures included water conservation, drought emergency measures, upstream storage and release of water, interbasin transfer of water, groundwater development, growth restrictions, as well as resource augmentations measures.

Review

In general, this is an interesting and valuable report. The organization is somewhat confusing. The chart on page vii helps somewhat, but a brief description of the relationship of the studies, reports, appendices, etc to one another would help.

One overall comment, the biological assessment did relatively little comparison between recent ecosystem responses to reduced flows (in 1980 - 1983) and predicted effects. If this information is available, it should be factored into the final report. Admittedly, the biological responses to temporary drought (as opposed to permanent consumptive loss) will differ in degree, but the comparison is worth making. For example, recruitment of riverine spawning fish has been poor. There have been increases in oyster mortalities due to MSX and "dermo" disease moving into Maryland waters. During the early 1980's, many beds of SAV in the mid Bay region decline or failed to regrow in spring; this was apparently due at least in part to excessively high salinities in these usually low mesohaline reaches. Some this material does show up in the appendices. However, as this sort of empirical evidence strengthens the COE case, it should be included in the main report as well.

Appendix E, the Biota Assessment, contains a useful summary of ecological data on various Bay species. Apparently, there is also a map atlas showing "actual" and "potential" distribution in Chesapeake Bay, based on an average flow year (pg B-1). This would be good reference material to include with the species descriptions in Appendix A.

Table III-1 on page 68 has Gammarus daiberi favored by low flow conditions. This oligohaline species is correctly shown as being adversely impacted in both Appendix A & E. The table should be corrected. The same table lists "depletion of oxygen" being favored by low freshwater inflow. Actually, high inflows, which increase stratification, appear correlated to the anoxic phenomenon. This is what most of the field data indicates (see EPA "Profile" report). Also, the report tends to combine conceptually "tidal fresh" and "oligohaline" phyto- and zooplankton, SAV, marshes, etc. These are not at all the same. It would be clearer to list in Table III-1 as Tidal Fresh/Oligohaline ----------, for example. *Otherwise a reader gets the superficial* erroneous impression that tidal fresh areas are not impacted.

The findings and recommendations appear, generally, reasonable. One important recommendation which relates to the Chesapeake Bay Program is, "All future efforts related to solving the problems of Chesapeake Bay and all plans for *use of its waters fully consider the effects of the proposed actions on fresh*water inflows to the Bay. Where possible, all plans should incorporate features that minimize adverse impacts associated with increasing consumptive loses of water and drought events. They should also strive to maintain the

natural seasonal variations in freshwater inflow."

Other recommendations which relate to CBP goals involve research needs, including: Bay hydrodynamics, delineation of nutrient budgets, sediment input and distribution, relationship between freshwater inflow and water temperature, life cycles and interactions of organisms, development of a three-dimensional numerical hydrodynamic model for prediction and need for a real time monitoring system for various parameters.

COMMENTS INCORPORATED AS NOTED

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

June 29, 1984

OFFICE OF
RESEARCH AND DEVELOPMENT

Mr. William E. Trieschman, Jr.
Department of the Army
Chief, Planning Division
Baltimore District, Corps of Engineers
P.O. Box 1715
Baltimore, MD 21203

Dear Mr. Trieschman:

I have reviewed the draft final report, entitled "Chesapeake Bay Study". It is well organized and a complete description of the program. The report should provide much useful information to those responsible for the management of Chesapeake Bay's resources.

I appreciate the opportunity to have been a part of the program's review process.

Sincerely

David A. Flemer, Ph.D.
Water and Land Division

NO RESPONSE NECESSARY

SMITHSONIAN ENVIRONMENTAL RESEARCH CENTER
12441 Parklawn Drive
Rockville, Maryland 20852-1773
P.O. Box 28
Edgewater, Maryland 21037

June 29, 1984

Mr. William F. Trieschman, Jr.
Department of the Army
Baltimore District, Corps of Engineers
P.O. Box 1715
Baltimore, Maryland 21203

Dear Mr. Trieschman:

Please excuse my delay in responding to your request for comments on the draft report on the Chesapeake Bay Study. The Smithsonian has no suggestions for changes to be incorporated in the final report.

Sincerely,

David L. Correll

David L. Correll
Assistant Director
Edgewater

DLC/mlm

NO RESPONSE NECESSARY

United States Department of Agriculture

Soil Conservation Service

4321 Hartwick Road, Room 522
College Park, Maryland 20740

July 2, 1984

Mr. William E. Trieschman, Jr.
Chief, Planning Division
Department of the Army
Baltimore District, Corps of Engineers
P O. Box 1715
Baltimore, Maryland 21203

Dear Mr. Trieschman:

I have reviewed the draft of the final report on Chesapeake Bay Study and have no comments to offer.

Sincerely,

Gerald R. Calhoun

GERALD R. CALHOUN
State Conservationist

NO RESPONSE NECESSARY

Department of Energy
Washington, D.C. 20545

JUL 3 1984

Mr. A. E. Robinson, Jr.
Department of the Army
Baltimore District Corps of Engineers
P. O. Box 1717
Baltimore, Maryland 21203

Dear Ted:

As per our prior discussion I have briefly looked through the Draft Summary Report for the Chesapeake Bay Study and read the chapter on the low freshwater inflow study. It seems generally well set out to me; the probability of future drought years like those of the mid-sixties and the consequences which could follow are certainly sobering thoughts.

I believe I noticed somewhere the conclusion that inter basin transfers were ruled out as an abatement procedure. I don't disagree with the conclusion, but it's my understanding this already exists on a large scale, as in late summer half of the (net, non-tidal) flow in the Patuxent is in fact water from the Susquehannah passing through Columbia.

Thanks for the opportunity for review and comment.

Sincerely yours,

D. Heyward Hamilton

D. Heyward Hamilton
Ecological Research Division, ER-75
Office of Health and Environmental
Research, Office of Energy Research

NO RESPONSE NECESSARY

COLLEGE OF WILLIAM AND MARY
VIRGINIA INSTITUTE OF MARINE SCIENCE
SCHOOL OF MARINE SCIENCE

Gloucester Point, Virginia 23062

12 July 1984

Phone (804) 642-2111

Mr. William E. Trieschman, Jr.
Chief, Planning Division
Department of the Army
Baltimore District, Corps of Engineers
P.O. Box 1715
Baltimore, MD 21203

Dear Bill:

I received the Draft set of the final report of the Chesapeake Bay Study a few months ago. Your request for comment was included.

Because of my earlier involvement with the comprehensive review of the low-flow project and with continuing reviews of the other phases of the work, as well as the press of other duties which prevented a thorough reading of the 17 documents involved, I decided that no further input from me was necessary. And I did not comment formally.

Dr. James McKay called yesterday and indicated that a "close-the-loop" letter would be desirable. Here it is.

As indicated to Dr. McKay I have no comments to make on the draft of the final report of the Chesapeake Bay Study.

I presume that the project will terminate when the final report is submitted and accepted. Should these occurrences signal the end of our regular contacts I wish to say that it has been a privilege and pleasure to work with you, Ted Robinson, Jim McKay, the several District Engineers who have come and gone during the fifteen or so years of the program, Noel Beegle and the several others from the district office on this project. If I can assist the Corps in other Bay-related or estuarine, coastal and marine efforts, please do not hesitate to call on me.

I look forward to receiving a complete set of the final version when it is printed. Please be sure that one is forwarded to me. It will be of use in my future studies of the Bay.

Best wishes for the future.

Sincerely yours,

William J. Hargis, Jr.
Professor of Marine Science

WJHjr:es

NO RESPONSE NECESSARY

Citizens Program for the Chesapeake Bay, Inc.

July 20, 1984

Mr. William E. Trieschman, Jr. Chief
Planning Division, Baltimore District
U.S. Corps of Engineers
P.O. Box 1715
Baltimore, MD 21203

Dear Mr. Trieschman:

On behalf of the Citizen's Program for the Chesapeake Bay, Inc., I am pleased to comment on the draft of the final report on the Corps of Engineers Chesapeake Bay Study. The comments concerning events that involved the CPCB, Inc. early in the study, are paraphrased from those of the Chairman of the Board of Directors of the CPCB, Inc., Mr. W. Cranston Morgan. Further, we have not attempted to provide a review of the entire report. Those portions of the report dealing with Tidal Flooding Study, for example, are outside our specific interests. It is our view that tidal flooding will continue to be a problem for the several communities that lie at elecvations near mean elevations of the Bay's surface. That several such communities are certain ultimately to disappear is inevitable. However, we recognize that there will continue to be a need for afford these communities reasonable protection for an indefinite period. At some time in the future, however, when costs of protection become exhorbitant, they will have to be abandoned.

We believe the report to a highly organized and detailed report that adequately covers the issues that were to be addressed. It is certainly a tremendous compendium of Bay-related information. We consider the general conclusions to be accurate and reflect the public interest.

Naturally, projections of future conditions must be predicated on demographic changes as well as the dynamic evolution of natural systems. Such projections are always hazardous, because it is impossible to predict what unexpected events will occur.

A classic current example is that of the accidental introduction of the water plant Hydrilla, which now is spreading in the Potomac and is found in other water bodies tributary to the Chesapeake Bay. Like water chestnut and Asiatic milfoil, Hydrilla must be lived with, yet it is impossible to predict with accuracy what that will entail.

Perhaps the best way to express our general view of the Future Conditions Report is that while one may argue over the specifics of the "time-table", the events projected are virtually certain to occur at some point. We are particularly concerned that the Report's warnings about the adverse effects of continued diversions and extractions of freshwater flows into the Bay will not be given sufficient credence in long-range planning carried out by the Bay communities. Unless there is general public recognition and understanding of the deleterious consequences of substantial tapping of the flows of the Bay's tributaries, the ecological dynamics of the Bay are certain to change, as the report describes, to the unquestionned detriment of ecological, social, and economic bases of the entire Bay community. We hope that this portion of the report will be highlighted and disseminated widely throughout the Bay region.

Those portions of the report dealing with public participation in developing standards for the report and identifying both resources and sectors of the concerned public are in accord with our recollection. Several members of the CPCB, Inc., at the time (1973 to 1978) notably Mr. Morgan, Mr. Edward Aiton, and Mr. Charles W. Coale, Jr. individually and through the medium of public meetings which they helped organize, contributed substantially to public involvement in the study. More recently, while the direct relationship has not been as close, the CPCB, Inc., under grants from the Environmental Protection Agency has continued an active public participation program related to the EPA Chesapeake Bay Study. In several respects, that is, where concerns of the two studies overlapped, the benefits of the EPA financed activity have been available to the Corps of Engineers study.

In as much as the Report identifies the reduction of freshwater inflows to the Bay as perhaps the most serious and far-reaching phenomenon to impact the Bay, we believe it would be desirable in the listing of "Recommendations" to give those related to reduction of freshwater inflow greater significance by placing them at the beginning of the "Recommendations". Those numbered 4 to 7 inclusive deal with this problem and could be made more effective if given first ranking.

We would recommend further that Recommendation 7, which calls for a continuing program for research into 8 areas of crucial significance to the Bay's future be emphasized in any future revisions of the Report. We are apprehensive that as a result of the completion of this study, and that of the Environmental Protection Agency, there will be a tendency on the part of the governments involved to give less attention to essential studies. While we agree that action on the Bay's demonstrated problems should not be delayed "pending further studies", it is nevertheless imperative that a strong study program be continued on the Bay in the areas the Report suggests.

Recommendation 12 proposes a "data information and retrieval system". We believe that you are aware that the CPCB, Inc. with a grant from the National Science Foundation, studied the feasibility of and

proposed the establishment of a Chesapeake Bay Information Center in 1982 and 1983. A copy of the report developed under that study is attached. Also, we are enclosing a copy of a proposal for a grant for funding such a CBIC. This proposal has been forwarded for consideration to the Virginia Environmental Endowment, and the W. Alton Jones Foundation. If funded, the proposal would go far toward meeting the requirements of Recommendation 12.

We appreciate the opportunity to review and comment on the report.

Sincerely yours,

John S. Gottschalk
President
CPCB, Inc.

cc: CPCB Board

Citizens Program for the Chesapeake Bay, Inc.

July 12, 1984

Mr. Gerald P. McCarthy
Executive Director
Virginia Environmental Endowment
700 East Main Street
Richmond, Virginia 23206

Dear Mr. McCarthy:

On behalf of the Citizen's Program for the Chesapeake Bay, Inc., I am pleased to transmit herewith a proposal (Attachment A) for major funding for the creation of a Chesapeake Bay Information Center.

The need for such a center has become acute with the growing public and official interest and concern for the future of the Chesapeake Bay. As an organization, we became involved in the problem of dissemination of Bay-related material several years ago. Our study of the feasibility of a Chesapeake Bay Information Center under a grant from the National Science Foundation was the result. A copy of the report emanating from that study is attached to our proposal (Attachment B).

The states of Virginia, Maryland, and Pennsylvania, the District of Columbia, and the federal government have come together through the Chesapeake Bay Council to carry out a program for the restoration and protection of the Chesapeake. The need for a mechanism to link this cooperative effort with the many Bay constituencies is critical.

We believe our proposal, if accepted and supported, will be the keystone in assuring continued citizen interest at a high level of understanding, and an equally important tool in maintaining cooperation between the various local, state, and federal agencies directly involved in the undertaking. It can result in the ultimate model of public-private interaction in the improvement of decision making capabilities related to public policy affecting the Chesapeake Bay. It will be a major adjunct to the clarification and resolution of critically important water resource issues involving the use of the Chesapeake Bay now and in the future.

Mr. Gerald P. McCarthy - 2 - July 12, 1984

As you will see by an examination of the proposed budget (Attachment C), we are making a request to the VEE for essential start-up and first year funding. We expect, however, to pursue vigorously the securing of additional funds from other private sources, and intend to submit this proposal to those sources in the expectation that support will be forthcoming from them in subsequent years to substantially reduce dependence on the VEE in years 2 and 3 and subsequently.

The proposal herewith submitted has been prepared with the assistance of several members of the Planning Committee that studied the information center idea under the NSF grant. The principal authors were Dr. J. Kevin Sullivan, Secretary of the CPCB, Inc., and Mrs. Frances Flanigan, Program Director of the CPCB, Inc.

In support of our proposal, there are also enclosed a brief description of the CPCB, Inc., consisting of an article prepared by Linda Griffin (Attachment D); a list of our current Board of Directors (Attachment E); and a copy of the letter from the Internal Revenue Service dated May 8, 1978 indicating that the CPCB, Inc. is tax exempt under section 501(c)(3) of the Internal Revenue Code, and that we are not considered a private foundation under Section 509(a) of the Code (Attachment F). Moreover, to the best of my knowledge, we have never been nor are we now under investigation by the IRS with respect to these matters.

If you desire further information, the individuals indicated above are listed with their telephone numbers and addresses as members of the Board of the CPCB, Inc. in the attachment.

Yours very truly,

John S. Gottschalk
President
CPCB, Inc.

1412 16th Street, N.W., Washington, DC 20036

THE CHESAPEAKE BAY
INFORMATION CENTER

A Proposal Submitted
to the
VIRGINIA ENVIRONMENTAL ENDOWMENT

by the
Citizens Program
for
Chesapeake Bay Inc.

ATTACHMENT A

INTRODUCTION

A remarkable opportunity exists in the Chesapeake Bay region to demonstrate that natural resource management and water quality improvement can be successfully accompl shed when science, government, business and the public work together toward a common, well-defined goal.

The completion of the EPA study and the signing of the Chesapeake Bay Agreement of 1983 have created this unprecedented opportunity. The states in the region, especially Virginia and Maryland, gave substances to promises made at the Governors Conference when, in the 1984 sessions of their General Assemblies, legislation and budgets were enacted which will enable a significant acceleration of Bay clean-up programs. The states and EPA have been meeting regularly to discuss implementation plans and schedules for the Bay. All of this activity suggests that government, using new information provided by the scientific community and responding to the forcefully articulated concerns of the public, is prepared to tackle the enormous job of "saving the Bay".

This proposal addresses the three most fundamental aspects of the Chesapeake Bay clean-up program, its complexity, its long-term nature and the need for public involvement. In order to succeed, the program must be understood by citizens of the region so that they can provide the continuing support necessary for government to accomplish its goals. Therefore citizens, public officials and legislators will need access to timely and accurate information. The need for and role of information is the subject of this proposal.

The current state of the Bay has recevied widespread publicity and caused substantial national concern as evidenced in the remarks of President Reagan in his 1984 State of the Union address. As a result, the federal government has made a substantial commitment of resources for initiating clean-up activities and the State of Maryland and the Commonwealth of Virginia have undertaken large scale pollution control programs. However, the magnitude and complexity of the efforts necessary to restore the Bay to its earlier healthy state are vitually unprecedented. In other bodies of water where water quality has been of concern (e.g., The Great Lakes, Lake Tahoe, the Ohio River) the solution to the problem has been relatively simple and clear-cut: upgrade sewage treatment facilities. In the Chesapeake, the solution is far more complex and touches every segment of society in the Bay's watershed. Solutions must include the farmer in seeking to reduce nutrients and sediments in agricultural land run-off; the city dweller in upgrading municipal sewage treatment plants; the suburban resident in providing storm water management programs and land use controls for dealing with non-point sources of pollution; and industry in cleaning up toxic waste. Moreover, effective action will require sustained effort for more than a decade.

It is the contention of the Citizens Program for the Chesapeake Bay, Inc., based on careful analysis, that the current and proposed institutional framework for the multi-state, public-private effort to restore the Bay is lacking. What is needed is an adequate link between government and the private sector to assure delivery of timely, accurate information on the progress, success, costs, and needs of the clean-up program. Without this link, the Chesapeake Executive Council will be unable to sustain the momentum generated in the past 11 months, and the promises of the 1983 Governors' Conference will likely not be realized.

We are proposing to create a mechanism that will link government agencies, academic and scientific institutions, the business community and the public through an information network. If this link is successfully established, long-range, complex policy issues can be addressed using the best objective information available, generated by a non-biased, professional organization dedicated only to the well-being of the Bay.

PROPOSAL

CPCB, Inc. proposes to establish a Chesapeake Bay Information Center and network in Virginia and Maryland, to be governed by an independent board of directors, staffed with funds from the private sector, and supported with in-kind contributions from federal and state governmental agencies.

The goal of the Center is to make possible sustained, effective public involvement in the long term implementation of strategies agreed to by the state and local governments and the EPA to clean up Chesapeake Bay.

The Center will offer a wide range of services to meet this goal. Center staff will refer clients to identified personnel within agencies, research institutions and private organizations, who can respond to specific questions. Ability to perform this service implies that Center staff must become extremely knowledgeable about the multitude of agencies which now manage the Bay. The Center will compile a director of sources to aid in accomplishing this task. It will identify and make available educational materials about the Bay, develop public information materials about specific Bay issues, and act as a resource for clarifying such issues. The CBIC also will establish linkages with existing information sources, either by automated means or by referral. Access to the Center will be through toll-free phone numbers, written request, or walk-in to the two offices.

To be effective, it is essential that the Center be sustained by non-governmental funding. While it is clearly in the long range interest of government to have such an entity operating in the Chesapeake Bay area, its services and products may be questioned if they were to be seen as government-produced. The value of the new institution we are proposing lies in its ability to generate material that is impartial and

objective. Because its focus will be on policy questions related to long range Bay management, independent support, qualified staff, and a governing board with impeccable credentials are critical elements of the proposed Chesapeake Bay Information Center.

The Environmental Protection Agency has expressed its approval of the concept of an Information Center by agreeing to provide office space for an office, to be co-located with the EPA office in Annapolis. The EPA also would provide access to their "CHESSEE" information system, which is the central depository of all data and information developed in the Chesapeake Bay Program, and share a portion of its data management staff time to serve CBIC needs. EPA's offer obviously represents a major commitment to the CBIC both in terms of easy access to a major information system and in administrative and logistical support. In Virginia, the CBIC office would be located at the Virginia Institute of Marine Science of the College of William and Mary. VIMS manages the largest and most sophisticated set of information systems dealing with the Bay, and has a long tradition of providing user oriented public information. In addition to making office space available for the CBIC, VIMS would incorporate the Center into its education and outreach programs in the recently completed Watermens Hall. A substantial amount of drop-in and tour visitation is planned at the Hall which should guarantee high visibility and use of the CBIC office.

During the second year of the project, other satellite offices will be sought in Pennsylvania, the District of Columbia, and elsewhere in Maryland and Virginia.

Many of the major federal, state and local agencies concerned with the Bay have indicated that they would designate a CBIC liaison person who would be responsible for directing the CBIC staff to the appropriate source of information within the agency. This liaison system would provide a network of persons who are familiar with CBIC needs and have the authority to meet information requests relevant to each agency.

Finally, the CPCB has requested support for the CBIC as an adjunct to the work of the Chesapeake Executive Council. The Executive Council will consider this issue at its July 23 meeting in Washington, D.C.

The concept of a Chesapeake Bay Information Center was developed by CPCB in 1982, after an intensive year-long feasibility study sponsored by the National Science Foundation. During this study, CPCB, assisted by a planning committee composed of goberment and private sector individuals with expertise in the areas of information generation and delivery, assessed the effectiveness of existing programs with regard to public information, the need for policy-relevant information, the potential users of an information center, and an array of alternatives services and structures which could meet the identified need. The conclusion of the CPCB study to recommend creation of a new institution to serve the information needs of the Chesapeake Bay publics, is contained in a report to the National Science Foundation (see Attachment B). Enthusiasm for the idea was reaffirmed at a workshop convened by CPCB in April 1984 to

discuss public information needs and participation aspects of the long range clean-up plans which are being launched by Maryland and Virginia.

Because of the support anticipated from EPA and the states, the CBIC will be able to operate with a relatively small staff and budget. The executive director will be responsible to the board of trustees, and will share with the trustees the responsibility for fund-raising, program design and oversight, and public relations. Information specialists in the Virginia and Maryland offices will deal with requests for information, access to computer-stored information, generation of a fact sheets and other materials for the public. One additional person will be responsible for the technical aspects of computer-generated information.

If limited funds can be secured by September 1984, with operational funds available January 1, 1985, the following implementation schedule can be met:

IMPLEMENTATION SCHEDULE

The following sequence of events are planned for establishment of the CBIC:

September 1 - December 30, 1984 - Pre-Operational Period.

1. Establish a Board of Directors for the Center;
2. Recruit staff for January 1985 opening;
3. Locate and define data and information sources available in federal, state and local agencies, university laboratories and private organizations;
4. Identify key contact persons in each agency;
5. Develop and implement a publicity program for CBIC opening;
6. Plan for space and other logistical requirements in EPA and VIMS offices.
7. Establish phone and computer liaison between Annapolis office and the Virginia office;
8. Seek incorporation of the Center.

January 1, 1985 - December 30, 1985 - Year 1 Operation

Operational Activities

1. Respond to referral requests;
2. Prepare a directory of information sources;

3. Continue outreach activities;

4. Prepare information "briefs" on a regular basis;

5. Implement in-House information system;

6. Conduct at least one annual workshop on Chesapeake Bay information needs and sources.

Planning and Development Activities

1. Identify other satellite office locations;

2. Continue inter-agency liaison efforts;

3. Seek financial support;

4. Begin compilation or Bay-oriented education materials;

5. Begin planning a Chesapeake Bay computer graphics education system.

BUDGETS

The proposed budget for the pre-operational and first years operation at the CBIC is shown in Figure 1. It will be noted that in-kind support from cooperating agencies is also identified and represents a substantial contribution to the operation of the Center. These budgets reflect the conduct of activities enumerated in the Implementation Schedule.

John S. Gottschalk
President
CPCB, Inc.
July 12, 1984

PROJECT EVALUATION PLAN

A project evaluation system consisting of two levels of policy and activity review is proposed. These would consist of first, a continuing review process conducted by a special committee of the CPCB, Inc. This committee would be established by formal action of the CPCB, Inc., and would be composed jointly of members of the Board of the CPCB, Inc. and persons who were members of the Chesapeake Bay Information Center Planning Committee that produced the National Science Foundation funded Information Center report. This committee would serve as the direct linkage between the CPCB, Inc. Board of Directors and the staff of the Information Center. It would be instructed to meet on a bi-monthly basis to review the activities of the Information Center, and would report to the CPCB, Inc. Board or Executive Committee promptly after each of its meetings.

The second level of project review and evaluation would be accomplished by an independent board of project monitors. There would be three members of this board, one from academia with experience in information theory, one with a practical background in information transfer technology, and one representing the concerns of the interested citizen. Specifically we have in mind Dr. Linda Scanlon, professor at Norfolk State University, who served in a similar capacity for the original planning study; Dr. Melvin Day, former director of the National Technical Information Service, and presently president of the Washington Knowledge Network of ITG; and Dr. Gilbert Gude, Director of the Congressional Research Service. These individuals have not been, but will be approached to see if they would be willing to serve. However, they illustrate the character and capabilities of those who would be recruited for the independent monitoring responsibility.

The project monitors would meet thrice during the project year, first at initiation, next at approximately six months into the project, and again at the end of the project period. At the beginning of the project they would establish familiarity with the project, and thus be in a position to critically examine the products of the Center during the course of the project year. It would be expected that they would individually provide written comments on the character and conduct of the Center's activities following each of their formal meetings.

The evaluation of the project would be based on 5 principal criteria, all of which relate to the primary objective of the Information Center, that is, to provide a Center for the acquisition and timely dissemination of Chesapeake Bay related information. The criteria are designed to establish a basis, as follows, for judging the effectiveness of:

1. The overall capability of the Center to provide an essential service to the Chesapeake Bay community (Public Service).

2. The "outreach" system in informing the public and specific user groups of the availability and capability of the Information Center (Public Involvement).

3. The institutional linkages between the Center and sources of original data and information (Coordination).

4. The Center management system in terms of developing and controlling the functions of the Center (Management).

5. The Center staff and the adjunct support system (initially, the CPCB, Inc., subsequently the independent corporation) in developing a satisfactory funding system (Funding).

FIGURE 1
START-UP AND YEAR 1 BUDGET
CHESAPEAKE BAY INFORMATION CENTER
(Amounts in dollars)

START-UP	Requested	Contributed	Total
Administrative Planning	10,000	5,000	15,000
Travel	900	500	1,400
Supplies	200	--	200
	11,000	5,500	16,600
YEAR 1 (CENTRAL OFFICE)			
Salaries:			
Executive Director	35,000	--	35,000
Resources Information Specialist	22,000	--	22,000
Information Management Specialist	25,000	--	25,000
Secretary	16,000	--	16,000
Total Salaries	120,000	--	120,000
Benefits (10%)	12,000	--	12,000
Total Salaries and Benefits	132,000		132,000
Other Costs:			
(A) Office rental	--	8,000	8,000
(B) Computer Services	--	7,000	7,000
(C) Consultant Services	--	3,000	8,000
(D) Information Services	--	25,000	25,000
Supplies	800	--	800
Utilities	--	2,400	2,400
Postage	500	--	500
Phone	3,000	--	3,000
Printing	1,000	--	1,000
Travel	2,500	--	2,500
Total Other Costs	12,800	45,400	57,200
TOTAL CENTRAL OFFICE COSTS	144,800	45,400	189,200

ATTACHMENT C

YEAR 1 (Virginia Office)	Requested	Contributed	Total
Salaries			
Resource Information Specialist	22,000	--	22,000
Typist (1/2 time)	8,000	--	8,000
Total Salaries	30,000	--	30,000
(E) Benefits (sec. note)	10,350	--	10,350
Total Salaries and Benefits	40,350		40,350
Other Direct Costs			
Office rental	--	2,000	2,000
Computer services	500	2,000	2,500
Consultant services	500	1,500	2,000
Information services	--	(see Central Off)	--
Supplies	200	--	200
Utilities	--	--	--
Postage	--	--	--
Phone	--	--	--
Printing	200	--	200
Travel	1,000	--	1,000
Total Other Direct Costs	2,400	5,500	7,900
Total Direct Costs	42,750	5,500	48,250
Indirect Costs (VIMS 46%)	19,665	--	22,195
TOTAL VIRGINIA OFFICE COSTS	62,415		70,445
TOTAL YEAR 1 CBIC COSTS	207,215	50,900	259,645

CBIC Board (12 members)

4 meetings/year	
Stipends ($100/meeting/person)	$ 4,800
Travel (Ave. $1,400/meeting)	5,600
Per Diem (Ave. $75/person/meeting)	3,600
	$14,000

Evaluation Program

Evaluation Committee (5 members):	
Two meetings (in addition to regular Board meetings) at same rate as above	$ 1,400
Monitors (3 persons, 3 site visits/year)	
Stipends ($200/person/meeting)	1,800
Travel (Ave. $600/meeting)	1,800
Per Diem (Ave. $75/person/meeting)	675
	$ 4,275

BUDGET EXPLANATION

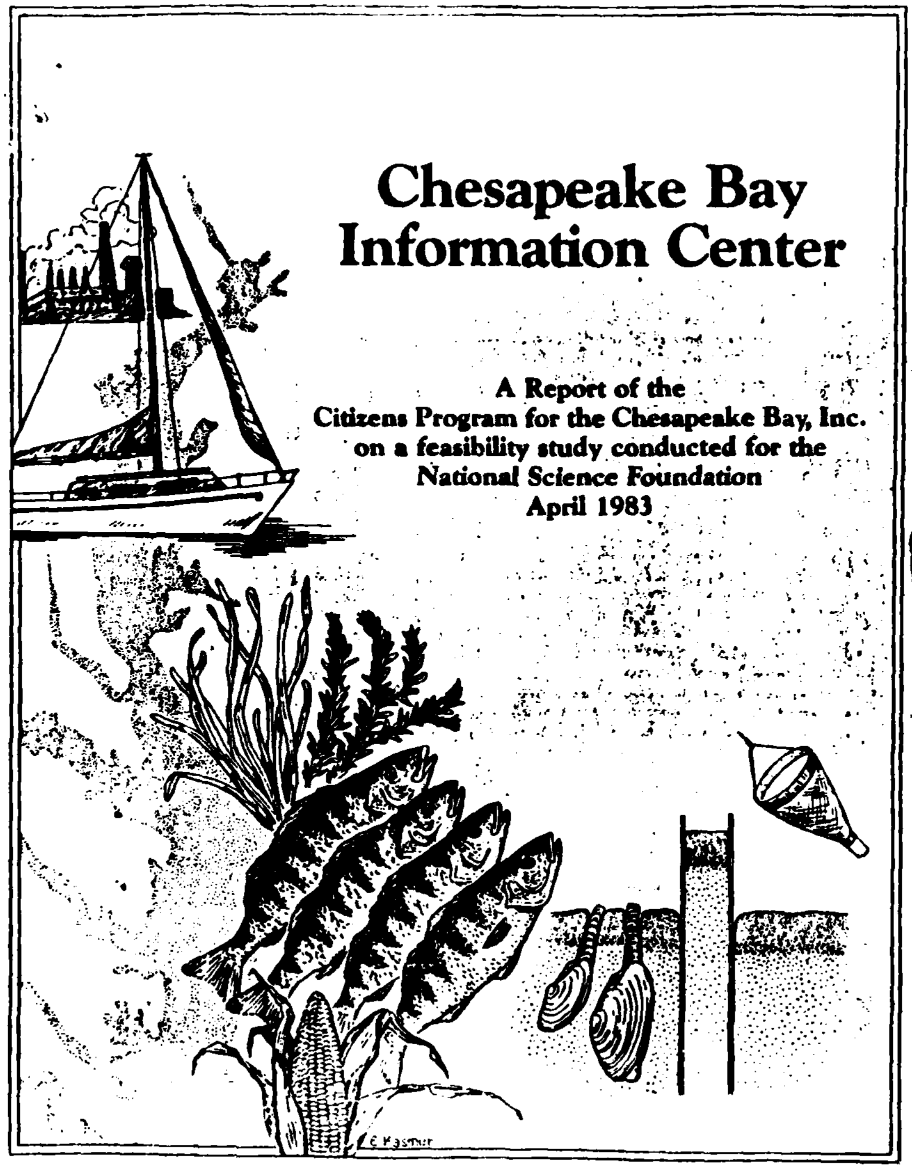
(A) Estimated value of equivalent rented office space in Annapolis and Gloucester Point

(B) Computer services represent the estimated value of the use of data processing facilities by the CBIC at the Environmental Protection Agency and the Virginia Institute of Marine Science.

(C) Contributed consultant services are provided by the EPA and VIMS for assistance in software development and programming. Direct consultant services are to be used for user surveys and other special technical project needs. These were estimated at $200 per day for 25 days of consulting time in the central office (2-1/2 days at VIMS).

(D) Information services represent the staff time in the various Bay-related state and federal agencies that will be contributed to the CBIC in referring or responding to information requests originally made to the CBIC.

(E) VIMS benefit rates are 44.5% on the information specialist (a full-time position) and 7% on the part-time clerical position.



FOREWORD

In 1979, the Citizens Program for the Chesapeake Bay (CPCB) approached representatives of management agencies, research institutions and citizens' organizations to determine if these groups thought a need existed for more effective and efficient production and dissemination of information about the Chesapeake Bay. Concern about this issue stemmed from the proliferation of federal and state programs impacting the Bay in the 1970's and the resultant fragmentation of information available to citizens interested in policy and management issues. Over 100 management agencies and 30 research institutions were identified as sources of Bay-related information. Many of the publications and newsletters of these groups contained similar material and, in some cases, the material presented might have benefited from information available in another agency. It was also clear that a more centralized and coordinated approach could substantially improve the effectiveness of existing information delivery systems, including dissemination efforts aimed at reaching groups not traditionally involved in Bay affairs.

To address these issues, the CPCB suggested that a planning study be undertaken to determine: (1) whether a need existed for a more coordinated approach to information management and dissemination; and (2) if a Chesapeake Bay information center or network would be *feasible*. Support for such a study was expressed by public and private institutions including the Smithsonian's Chesapeake Bay Center for Environmental Studies, Chesapeake Research Consortium, the Virginia Institute of Marine Science, the University of Maryland's Sea Grant Program, and state and federal resource departments as well as by citizens with an interest in the Bay region. As a result, the CPCB prepared a planning study proposal that was submitted to the Science for Citizens Program at the National Science Foundation. The proposal was approved and funded in January 1981 as the Chesapeake Bay Information Center (CBIC) project. The study proceeded in three stages: an introductory workshop; the formation and operation of a project Planning Committee, composed of individuals from the private sector, government information officers, water quality and resource program managers, extension agents, librarians, legislators, scientists and writers; and a final evaluation conference.

We are pleased, as members of the Planning Committee, to present this summary of the Final Project Report for the Chesapeake Bay Information Center Feasibility Study submitted to NSF in January 1983. We have outlined the issues considered in regard to the feasibility of an information center and have recommended the necessary steps to implement such a center.

Larry Minock
Dr. Sarah J. Taylor
Linda Smyrne
Linda H. Scanlan
Evelyn M. Hailey
Dwight E. Flowers
Frances H. Flanigan
William G. Wilson
John M. Zeigler
William P. Kerns
Suzanne Pogell

Recommendation and Need

The Planning Committee, after a year-long review of the management and dissemination of Chesapeake Bay information, recommends that:

A Chesapeake Bay Information Center should be created as a new, independent, non-partisan, incorporated organization, operating under a Board of Directors representing the interests and needs of the Chesapeake Bay community.

The need for such a center was explored by Planning Committee members, who outlined their perceptions of deficiencies in the generation and transfer of information. Later, a workshop attended by 100 people including scientists, legislators, management officials and Bay users discussed access to existing information, the usefulness of the information, and effective ways of disseminating information. The workshop attendees charged the Planning Committee to evaluate the need for establishing a new information exchange system.

The workshop also recommended that the Planning Committee conduct a survey of existing information sources in the Bay region, to identify gaps that currently exist. *Generators of Bay information* answered questions concerning their mission, the type of information they produce, the form in which it exists and the way in which it is made available to users. The survey results were compiled into a Directory of Chesapeake Bay Information Sources, serving as a working document for the feasibility study.

According to the Planning Committee's survey, four reasons exist for improving the generation and transfer of issue-oriented information about the Bay:

- The format of available information is not always appropriate to the user's need. Synthesized reports are often needed to aid users in gaining perspectives on issues of interest. The user's ability to apply information to specific issues is a problem;
- Timely access to, as well as awareness of, existing information sources is a problem. The "community" of information sources is not well organized, and the use and exchange of information is informal and piecemeal;
- Though scientists and government managers have a great deal of information exchange within their own communities, few mechanisms exist to transfer that information into a form appropriate for users who need it to participate in decision-making;
- Users have trouble framing questions to elicit the desired information. Expectations include success with a single phone call, rapid delivery, and quality information including current data and an overview of the issue.

Services/Scope/Feasibility

The Committee examined in detail a wide array of services that an information center might perform. These include directory, referral and bibliographic functions, education and outreach activities, and conflict resolution and issue identification services, among others. Each of these was carefully defined as to what specific options could realistically be offered and what functions they could perform. The services that were believed to be of greatest value in meeting information needs were the following:

Directory Services—Provide current information on sources of Bay information. This would include production of a looseleaf or microfiche directory;

Referral Services—Respond to individual requests for assistance; determine exact needs of requestor and provide specific source contacts; provide references by which the requestor can contact consultants or specialists on specific information needs, issues or mediation services;

Education and Outreach Services—Provide a location where a wide range of Bay-related materials may be viewed; work with interested parties to initiate and coordinate the production of Bay-related education materials; work with interested parties to initiate Bay-related community education and leadership programs.

Issue Identification and Clarification Service—Identify issues of interest to the Bay community, prepare nonbiased descriptions clarifying all sides of each issue, notify the public.

The feasibility of the proposed CBIC is dependent upon its ability to be compatible with existing information generators and distributors. The utility of the Center is directly related to its ability to provide a unique service, not to duplicate the functions of existing sources of information, and to work in a constructive way with the academic and governmental units concerned with the Bay. It was the clear expectation of the Planning Committee that the CBIC develop a non-competitive posture designed to enhance the constructive efforts of government and academia to provide information to the public. Several of the services evaluated by the Planning Committee were discarded because they are already or can be performed better by academia or government.

The CBIC is intended to serve as an information expeditor to ensure that the business of managing Chesapeake Bay is accomplished with the opportunity for knowledgeable involvement by the public. The Center will not be an advocate, but it will try to provide the most complete, current and accurate information on important issues. By reporting on the extent of the technical understanding of a particular issue, the possible courses of action, the anticipated costs, and the timeframe required for decision-making, the Center will provide a service unique in the Chesapeake Bay region.

In its exposition of issues, the Center will not attempt to analyze technical data or to second guess scientific findings. Divergent technical opinions will be presented, leaving the choice of which to accept to the public. In this way, the Center will avoid the potential pitfalls inherent in any attempts to analyze, interpret or otherwise manipulate scientific data.

Audience

It was pointed out early in the Planning Committee's deliberations that there are many potential audiences for the kinds of services being proposed for the Center. These include special interest groups, the scientific community, government officials, educators and the general public. The Committee acknowledged the need to target the proposed services to a clearly defined audience to keep the center manageable in scope and to prevent it from duplicating the efforts of other organizations. The Committee agreed that the primary initial audience for the Center is the concerned public, that is, those groups and individuals who are attempting to involve themselves in policy formulation and decision-making matters concerned with the Bay. Other audiences, including especially local officials, will also use the services provided by the CBIC. Initially, however, the concerned public will be the primary audience.

Staffing and Budget

The Planning Committee identified a minimal level of operation for the CBIC in its initial phase. The activities to be conducted would include:

1. Preparing a directory of information sources;
2. Developing the expertise necessary for referral of inquiries to the most appropriate information source;
3. Performing a pilot project on a single issue to assess the feasibility of the CBIC dealing with issue identification and clarification services;
4. Conducting a campaign to acquaint potential users and cooperators with the Center.

To perform these functions, the Information Center would need an initial budget of $115,000.00.

Projected Phase I Annual Budget

• Executive Director	$30,000.00
Administrative Assistant/Secretary	$15,000.00
Technical Analyst	$20,000.00
• Benefits	$15,000.00
Operating Costs (rent, supplies, telephone, travel, etc.)	$35,000.00
TOTAL COSTS	$115,000.00

Steps To Implementation

To implement the Planning Committee's concept, the following actions have been undertaken by the Board of Directors of the Citizens Program for the Chesapeake Bay, Inc.:

- CPCB is serving as interim sponsor for the CBIC, assuming responsibility for the administration and procedural details necessary to bring CBIC into existence,
- CPCB is seeking incorporation, non profit and tax-deductible status for the CBIC;
- CPCB is preparing a brochure for the CBIC's fund-raising and publicity efforts.

In addition to CPCB's efforts to implement the CBIC, the following actions must occur to make the CBIC a reality:

Establish bay-wide interest and support—The CBIC will not achieve success unless it receives widespread endorsement from key citizens and user groups, state and federal management agencies, and the academic community. A substantial effort must be made to obtain such endorsement,

Identify funding sources—It may be possible that the CBIC could be initiated with a relatively small amount of direct funding, relying on in-kind support from existing organizations for space, administrative assistance and staff. However, carrying out the functions specified for the Center by the Planning Committee will require a significant source of direct funds. The identification of these sources should be a high priority;

Establish a board of directors—Since the CBIC will be an independent organization, it must have its own Board of Directors. The Planning Committee recommends that the CPCB as the initial sponsoring organization should appoint a Board;

Locate a permanent home;

Conduct a pilot project to demonstrate what the center can do.

Possible pilot projects include:

- Expand the directory of Chesapeake Bay Information Sources,
- Develop background information on an issue,
- Conduct a media workshop,
- Create a Bay speakers' bureau,
- Develop materials to teach citizens how to ask appropriate questions,
- Computerize a Bay directory

NO RESPONSE NECESSARY

United States Department of the Interior

FISH AND WILDLIFE SERVICE
DIVISION OF ECOLOGICAL SERVICES
1825B VIRGINIA STREET
ANNAPOLIS, MARYLAND 21401

August 1, 1984

Mr. William E. Trieschman, Jr.
Chief, Planning Division
Baltimore District, Corps of Engineers
P.O. Box 1715
Baltimore, MD 21203

Dear Mr. Trieschman:

We have received your letter of March 27, 1984 and the draft of the final report on the Chesapeake Bay Study. We do not have any comments to offer at this time.

The Service has participated in the study from its inception. This office has been actively involved in and contributed to the Future Conditions Report and the Freshwater Inflow Study. We believe the Study will aid the Corps and others in future decisions about the Chesapeake Bay Region.

We appreciate being a part of this large effort and look forward to working with you in the future.

Sincerely yours,

for
Glenn Kinser
Supervisor
Annapolis Field Office

NO RESPONSE NECESSARY

ATTACHMENT B-6

NEWS CIRCULARS

CHESAPEAKE BAY STUDY
BALTIMORE DISTRICT • CORPS OF ENGINEERS

VOL. 1 DECEMBER, 1978

NEWS CIRCULAR

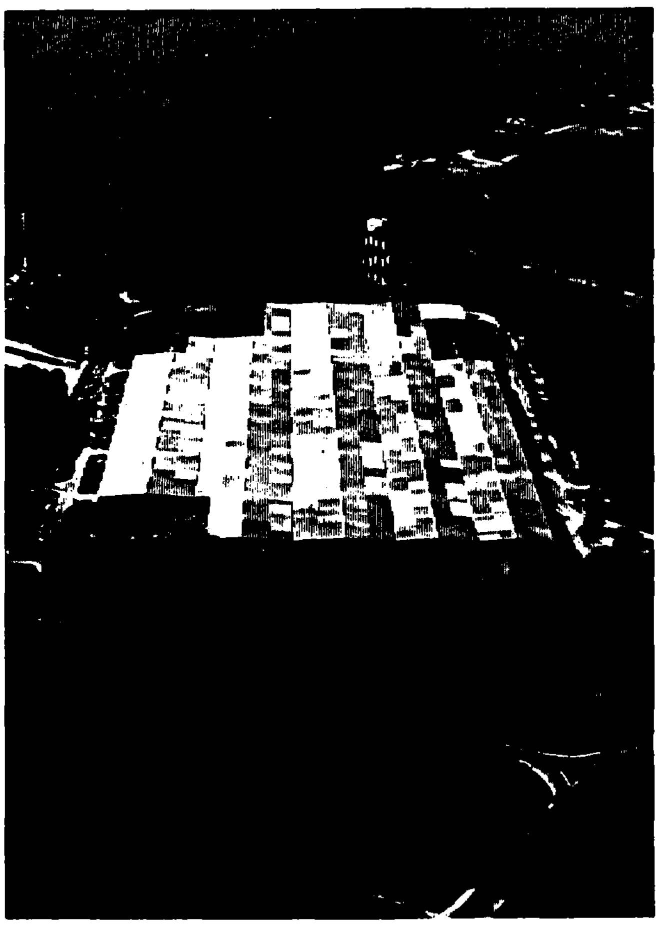
HYDRAULIC MODEL TESTING BEGINS ...

July 1978 is a most significant milestone in man's efforts to understand, preserve, and enhance Chesapeake Bay and its water resources. This date marked the end of verification and adjustment of the Hydraulic Model of Chesapeake Bay and the beginning of the first test—the Baltimore Channel Enlargement Study. At long last, a scientific instrument is available which reduces to a manageable scale that complex estuary known as Chesapeake Bay. Now water resource planners, engineers, and scientists will be able to analyze and provide solutions to many of the hydraulic problems which previously could not be effectively addressed.

The Chesapeake Bay Model is a versatile tool which accurately reproduces the hydrodynamic processes of Chesapeake Bay. Through the use of computer activated controls, man can now simulate the rise and fall of tides, changes in temperature, dispersion of pollutants, and salinity, current and shoaling patterns.

The model provides the means for both better understanding natural processes and for analyzing the consequences of both natural events and man-made changes. Because model time is compressed and operating conditions can be changed at will, it is possible to study the effects of changes under circumstances rarely, if ever, observed in nature.

View of Chesapeake Bay Hydraulic Model Shelter at Matapeake, Maryland



The list of studies for which model data will be invaluable is long—municipal, industrial, and agricultural water supply; power plant siting; floods; droughts; the location and size of waste-water plants; and geometric changes such as the deepening of channels or the construction of shoreline structures.

Consisting of molded concrete formed to the shape of the Bay, the model holds approximately 450,000 gallons of water at mean low tide. While the model has a total paved area of 8 acres, its average depth is only 3 inches, pointing out the fact that the estuary which it duplicates is a very large but shallow body of water. The model encompasses the Bay proper, its tributaries to the head of tide, and the adjacent overbank area to an elevation of 20 feet above mean sea level. To get a further idea of just how large the hydraulic model facility is, the 14-acre shelter housing the model is approximately 1,080 feet long and 680 feet wide.

Since its dedication in May 1976, the hydraulic model has been open to the public for visitation.

Tours of the facility are conducted Monday thru Friday at 10:00 a.m. and at 1 and 3 p.m. For information on large tour groups, it is suggested that the Baltimore District's Public Affairs Office be called at (301) 962-4616.

STUDY NOW IN ITS FINAL PHASE . . .

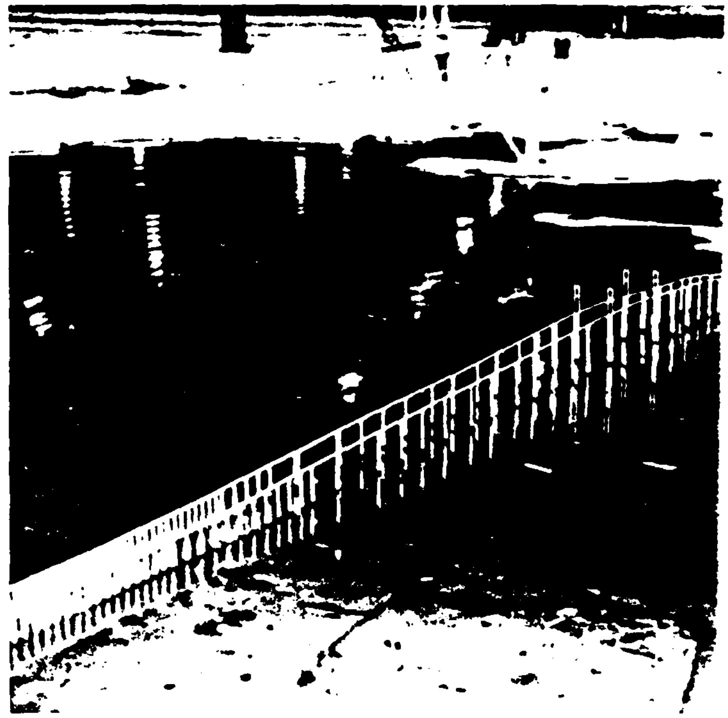
The overall objective of the final study phase is to formulate and recommend solutions to priority problems using the hydraulic model. Three studies, a Low Freshwater Inflow Study, a Tidal Flooding Study, and a High Freshwater Inflow Study, have been selected for further study and model testing based on a number of criteria. First, the studies had to be responsive to the original intent of Congress as specified in the study authority.

Second, the problems selected had to have Bay-wide significance and be of critical concern. They also had to avoid any duplication of work being conducted under other existing or proposed programs. Finally, they had to maximize the use of the hydraulic model. Selection was also based on the findings of the *Existing and Future Conditions Reports* as well as specific input from the Chesapeake Bay Study Advisory Group and Steering Committee and the public.

The Low Freshwater Inflow Study came about through the realization that continued growth in water consumptive activities in the drainage basins of Chesapeake Bay will result in reduced freshwater inflows that could seriously affect the Bay's ecosystem. The objectives of the low flow study are to first provide a better understanding of the relationship between Chesapeake Bay salinities and the freshwater inflow from its tributaries.

The second objective is to define the environmental and socio-economic impacts of both short and long term reductions of freshwater inflows. The final objective is to recommend those minimum flows that should be provided by the major tributaries in order to maintain the integrity of the Bay. To achieve these objectives, a series of tests will be run on the model to define salinity-inflow relationships occurring under a variety of low freshwater inflow conditions and to determine the influence of each of the major tributaries on Bay salinities.

Based on the results of the model testing, biological, economic, and social impact assessments will be conducted to determine the effects of changes in salinity. These assessments will serve to define both existing and potential problems as they relate to both short and long term reductions in freshwater inflows. The next stage of the study will be oriented toward formulating and evaluating alternative flows that would alleviate the problems. Lastly, final recommended flows will be selected based on further model testing results and on more detailed biological, socio-economic, and institutional assessments.



During the Final Study Phase the Hydraulic Model will be used to provide solutions to selected high priority problems.

From the time man first settled in the Bay region, he has been subject to periodic tidal flooding which has resulted in loss of life and immeasurable human suffering and property damage. Since the last major Bay-wide storm in 1933, considerable development has occurred along the shoreline of the Bay region. Thus, damages sustained during a tidal flood today would be much greater than that of just a few years ago. During the future conditions phase of the Chesapeake Bay Study, a number of communities in the Bay region were identified as having critical flood problems. The Tidal Flooding Study has three primary objectives.

First, to provide a better understanding of the tidal flood stage-frequency relationship in the Bay region as a whole and also in those communities which are subject to tidal flooding. Second, to define the environmental and socio-economic impacts of tidal flooding in those communities subject to flooding. Finally, to recommend structural or nonstructural tidal flood protection in those communities where it is found to be economically and environmentally feasible and socially acceptable. A numerical tidal surge model will be used to develop stage-frequency information for these critical flood prone areas. The hydraulic model will be used to calibrate and verify the flooding portion of the numerical model by simulating several storm surges of different fre-

quencies. The hydraulic model will also be used to investigate salinity problems associated with tidal surges and to determine the time required for the salinity regimen to return to "normal". Based on all of these data plus engineering, environmental, and socio-economic studies, those communities where some form of flood protection is feasible will be identified and authorization studies will be recommended.

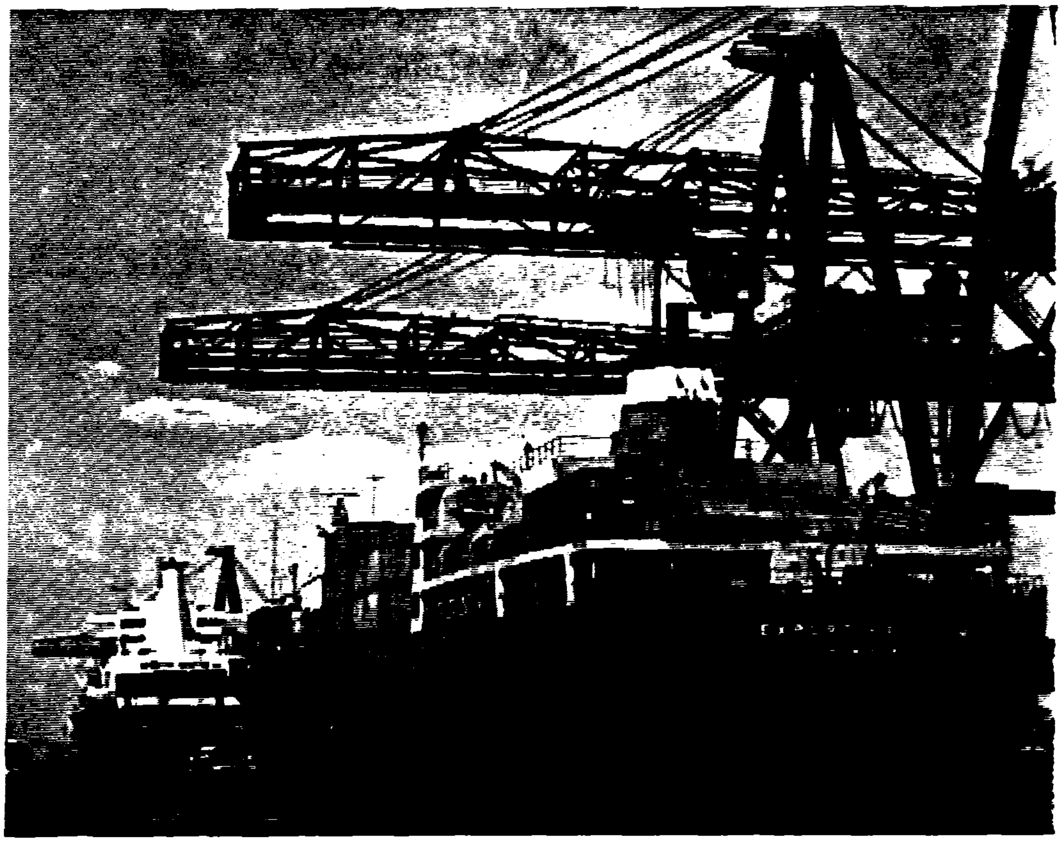
The $42 million in Bay damages brought about by the large influx of freshwater from Tropical Storm Agnes is proof that high volumes of freshwater can be detrimental to both man and to the Bay's ecosystem. Based on the magnitude of the impacts of Agnes and in response to the need to more precisely describe the physical changes that occur in the Bay during high flow events, the High Freshwater Inflow Study was proposed. The study has three major objectives. First, to provide a better understanding of the relationship between Chesapeake Bay salinities and high freshwater inflows from its tributaries. Second, to define the environmental and socio-economic impacts of high freshwater inflows into the Bay. Finally, to identify those structural or management measures that could be used to prevent or reduce the adverse impacts of high freshwater inflows.

During the High Freshwater Inflow Study, the hydraulic model will be used to reproduce three of the most severe historical Bay-wide high freshwater inflow events. For each of these events, salinity, current, and tidal elevation data will be recorded and an atlas will be prepared to document physical changes associated with high freshwater inflows. Environmental, social, and economic impact assessments will also be conducted based on these identified physical changes to the estuarine system. Finally, assessments will be made to define those structural and/or nonstructural measures that could be used to prevent or reduce any adverse impacts.

In addition to the three studies described above and as directed by the enabling legislation, the hydraulic model will be used for investigations conducted by agencies outside the Corps as well as for other on-going Corps studies. The Baltimore Channel Enlargement Study is designed to provide some of the data required to define the effects on the Chesapeake Bay system of deepening the Baltimore Harbor and approach channels from a depth of 42 feet to 50 feet. The Potomac River Estuary Water Supply and Wastewater Dispersion Study, which is being conducted as part of the Corps' Metropolitan Area Water Supply Study, is designed to explore the ramifications of using the Potomac River Estuary as a supplemental source of water supply for Washington, D.C. Studies will also be conducted for the State of Maryland in conjunction with its Power Plant Siting Program and for the Environmental Protection Agency in support of that agency's Chesapeake Bay Program.

A NEED EXISTED . . .

Chesapeake Bay is an invaluable natural, economic, and social resource which, unfortunately, is faced by ever-increasing pressures brought about by a rapidly growing population. Problems often arise when man's intended use of one resource conflicts with either the natural system or man's use of another resource. It was the need for a plan to provide for the most effective use of the Bay's resources that provided the impetus for initiation of the Chesapeake Bay Study.



The Chesapeake Bay Study Came About Through the Need for a Plan to Provide for Effective Use of the Bay's Resources.

Congress responded to this need by directing the Corps of Engineers to conduct a complete study of water utilization and control of the Chesapeake Bay Basin. Section 312 of the River and Harbor Act of 1965, which contained the authority for the Chesapeake Bay Study, also provided that a hydraulic model of the Chesapeake Bay Basin be constructed, operated, and maintained within the State of Maryland. Congress specified that the model be used by any agency of the Federal government or the states of Maryland, Virginia, or Pennsylvania, in connection with investigations of the Chesapeake Bay Basin.

The overall management of the study is the responsibility of the District Engineer of the Baltimore District, Corps of Engineers. The study was conceived, however, as a coordinated partnership between Federal and state agencies and interested scientific institutions. Each involved agency is charged with exercising leadership in those disciplines in which it has special competence.

The study of Chesapeake Bay is being accomplished in three distinct developmental phases. Each phase is responsive to one of the following stated objectives of the program.

1. To assess the existing physical, chemical, biological, economic, and environmental conditions of Chesapeake Bay and its related land resources.

2. To project the future water resources needs of Chesapeake Bay to the year 2020.

3. To formulate and recommend solutions to priority problems using the Chesapeake Bay Hydraulic Model.

In response to the first objective, the inventory phase of the program was completed in 1973. The findings of this phase were published in a document titled *Chesapeake Bay Existing Conditions Report*. This represented the first time a report had been published treating the Bay as a single entity and presenting a comprehensive survey of the entire Bay region. In response to the second objective, the future projections phase of the program was conducted and the findings of this phase were recently published in the *Chesapeake Bay Future Conditions Report*. The chief emphasis of this report is the projection of water resources needs and problems in the Bay region to the year 2020.

Each report contained basic information necessary to proceed into the next phase of the program. Thus, with the

A Future Increase in Urbanized Land Use Will Mean a Decrease in Agricultural Land.

recent publication of this second report, the District is ready to enter into the third and final phase of the study which will satisfy the study's third objective.

STUDY FINDINGS REVEAL RESOURCE CONFLICTS . . .

When man first came to the shores of Chesapeake Bay, he found one of the largest estuaries in the world—a pristine environment in harmony with nature. Barring certain natural destructive forces such as shoreline erosion and flooding, it was not until man's numbers reached sizeable proportions that the first serious and perhaps irreversible conflicts to the natural environment occurred. Today, man's misuse of the Bay's resources is highly visible in some areas.

By 2020, the region's population is projected to increase to 16.3 million—a number almost double the present population. As a result of projected population increases come expected increases in per capita income, manufacturing output as well as parallel increases in demand on the region's water and land resources. Valuable insight into these resource conflicts is provided by two major reports which have been published as part of the Chesapeake Bay Study: the *Existing Conditions Report* and the *Future Conditions Report*. Some of the more significant findings of these two reports are summarized below:

Land Use

Urbanized land use will increase significantly by 2020—residential land will double while industrial land use will increase by about 50 percent. This increase will result in less available land for both agricultural purposes and as habitat for the Bay's abundant wildlife resources.

Water Quality

Serious water quality problems exist primarily in portions of tributaries adjacent to large urban areas.

Increased population will mean increased municipal wastewater volumes. Likewise, increases in electric power demands will create problems with disposal of heated cooling waters.

Recreation

Present recreational de-

Much of the Shoreline of Chesapeake Bay is in Private Ownership Making It Inaccessible to the Public

Approximately 410 Miles of Developed Shoreline Has Been Identified as Having Critical Erosion Problems

mand for swimming, boating, camping, and picnicking exceeds existing supply in certain urban areas of the Bay region. Future demand for outdoor recreation is projected to increase significantly resulting in major deficits in number of boat ramps, picnic tables, and camping sites by 2020.

Water Supply

The 49 existing central water supply systems in the Bay region provide a total of 872 million gallons to many industries plus water to about 76 percent of the region's population.

By 2020, 31 of these 49 systems are expected to have average water demands exceeding presently developed sources of supply. Meeting future needs will require expansion of existing systems, which may cause negative impacts by reducing freshwater inflows into the Bay's subestuaries. Reduced inflows will likely increase salinities which may prove detrimental to the Bay's ecosystem.

Tidal Flooding

Based on the damage that could be expected from a 100-year tidal flood, the tidal flooding problem is considered critical in 32 communities in the Bay region. Approximately 27,000 acres of land in these 32 communities were found to be in the 100-year tidal flood plain.

Shoreline Erosion

During the last 100 years, approximately 45,000 acres of shoreline have been lost to erosion in Maryland and Virginia.

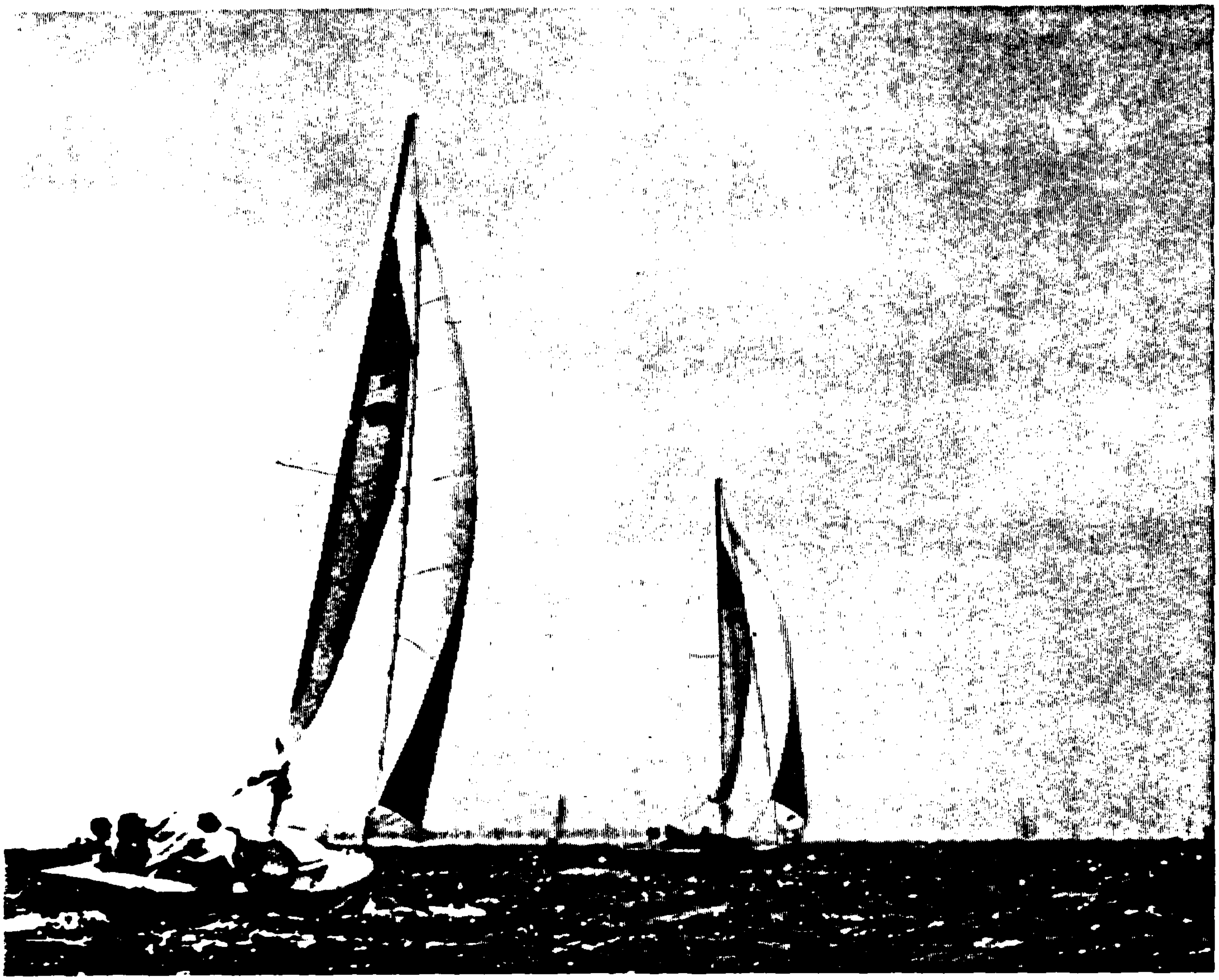
Approximately 410 miles of presently developed shoreline in the region have been identified as having "critical" erosion problems.

An additional 44 miles of critically eroding shoreline have been proposed for future intensive development.

Waterborne Commerce

A total of approximately 160 million short tons of cargo was shipped on Chesapeake Bay during 1974.

Future waterborne commerce is projected to



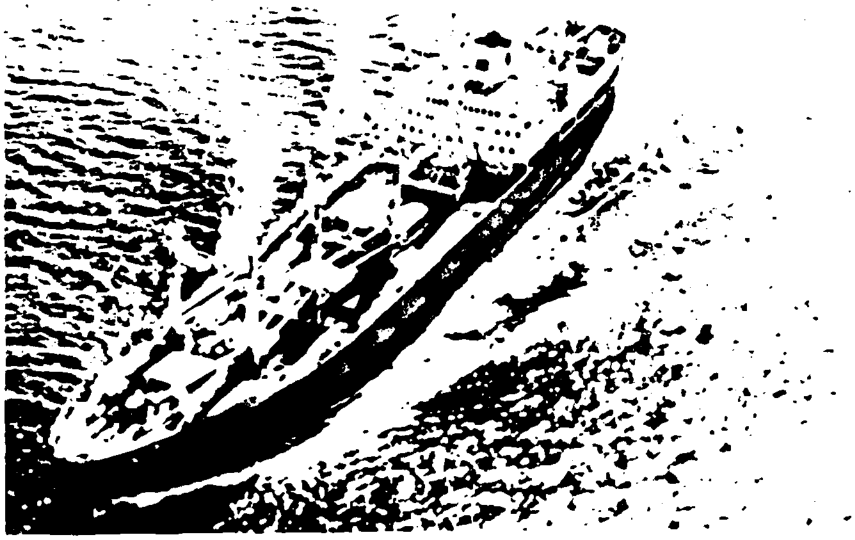
Future Demand for Outdoor Recreation Will Result in Major Deficits in Number of Boat Ramps, Picnic Tables, and Camping Sites.

The Bay Provides an Abundant Habitat for Hundreds of Species of Wildlife.

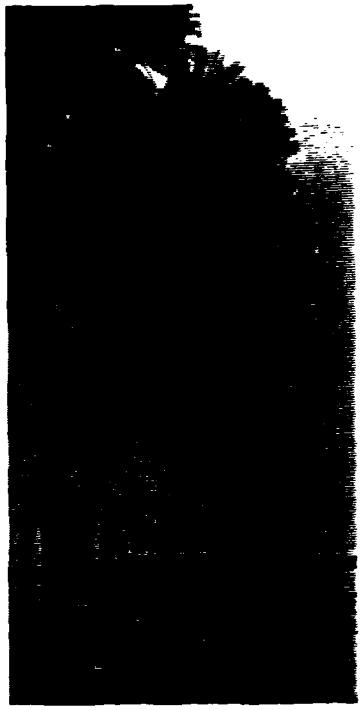
increase at a very high rate between now and 2020. These increases will intensify the need for deeper channels in the major harbors of the region and the resultant need for finding environmentally and economically acceptable methods of dredged material disposal. In addition, increases in waterborne commerce will mean greater congestion problems in port, channel, and anchorage areas.

Power

Demand for electricity is projected to increase by



A Total of 160 Million Short Tons of Cargo Was Shipped on Chesapeake Bay in 1974.



Expected Increases in Population in the Bay Region Will Mean Increased Pressures on the Remaining Pristine Areas of the Bay.

STUDY FINDINGS (Continued) . . .

five times by the year 2000 and by 13.5 times by 2020.

While water withdrawal by power plants is expected to decrease due to projected increases in water recycling, overall water consumption is projected to increase. This will decrease freshwater inflows to the Bay, thereby increasing salinities—a development which may prove detrimental to the Bay's ecosystem.

Fish and Wildlife
In 1973, the total harvest of finfish and shellfish from the Chesapeake totaled 565 million pounds valued at $47.9 million. Projections of future By 2020, the recreational and commercial catches of such valuable species as blue crabs, striped bass, and oysters will exceed the amount which can be safely harvested without affecting subsequent harvests.

Aquatic Plants
Aquatic plants form the basis in the food chain for the Bay's productive fish and wildlife resources. In recent years, and for as yet unexplained reasons, there has been an alarming decrease in the number of some of the most beneficial aquatic plants.

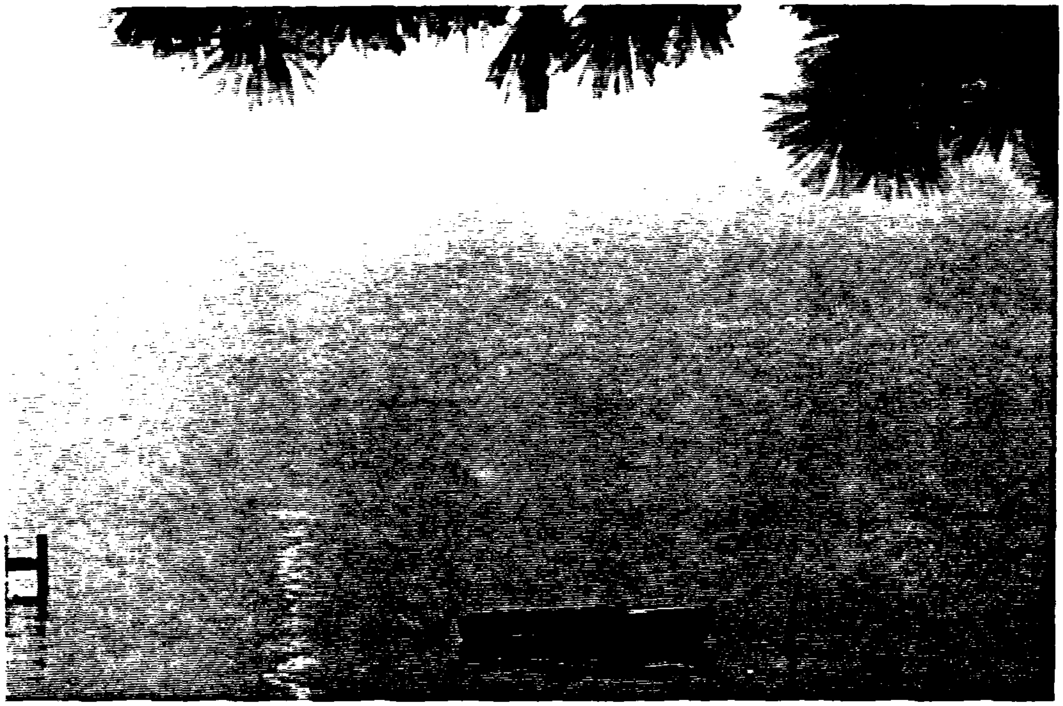
Both the *Existing Conditions Report* and the *Future Conditions Report* are available from the National Technical Information Service of the Department of Commerce. To purchase the summary of either of these two reports write:

U.S. Department of Commerce
National Technical Information Service
Springfield, Virginia 22161

the NTIS order number (AD number) and cost for the summary of each report is:

Existing Conditions
AD-A 005500 $7.25
Future Conditions
AD-A 052471 $7.25

For information on how to order the appendices to either of these reports, write for quote to the above address.



AND WHERE DOES THE PUBLIC FIT IN . . .

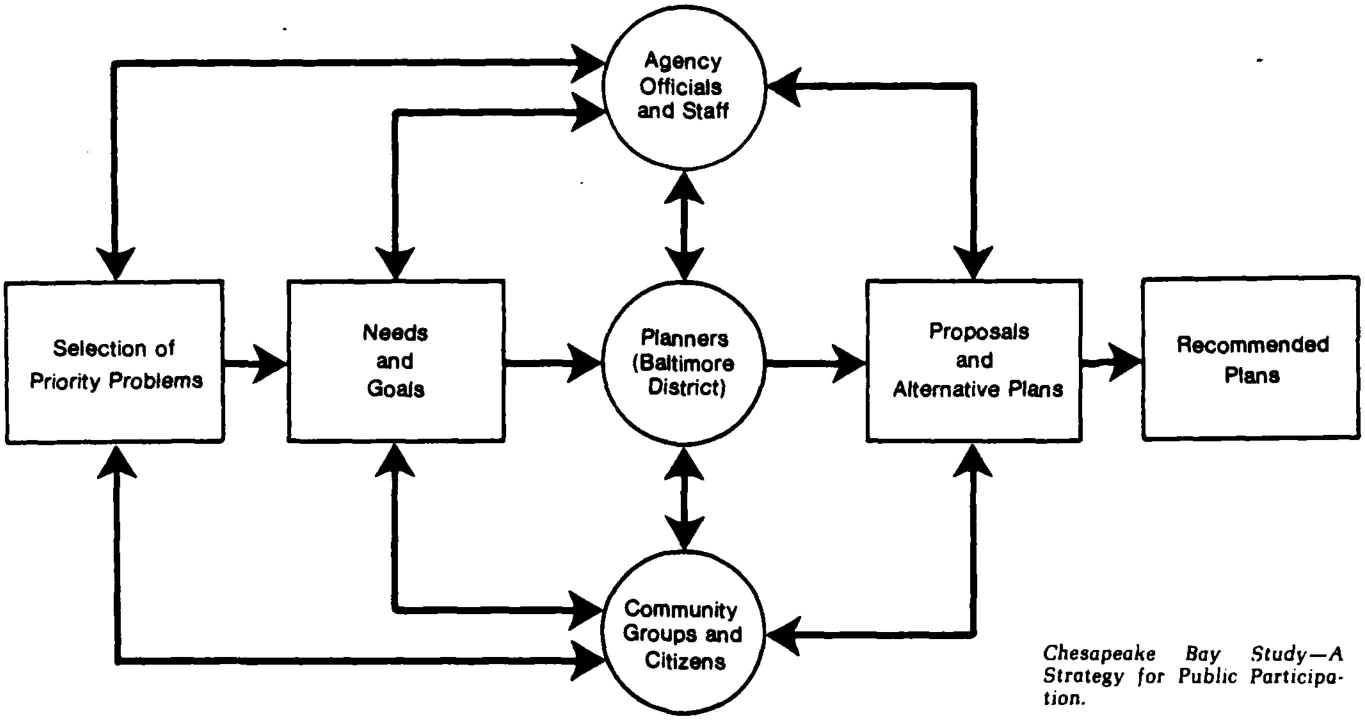
The Baltimore District recognizes the importance of actively involving each and everyone in water resources studies in order to insure that these studies respond to public needs and preferences. Since the beginning of the Chesapeake Bay Study, the general public has been kept informed of Study progress. Your comments concerning the study have been requested and positive action has been taken whenever appropriate.

The Corps defines the "public" as any affected or interested non-Corps of Engineers entity. Thus, an important part of the public involvement program for the Chesapeake Bay Study has been coordination with those Federal and state agencies and institutions concerned with water resources planning in the Bay region. The magnitude and nature of the study, in fact, has required quite intensive coordination among these groups. To achieve this coordination, a number of study groups comprised of both Federal and state agency representatives were established early in the study.

These groups included an Advisory Group, to provide guidance to the District Engineer regarding study policy and to provide the general direction under which the study participants have operated; a Steering Committee to review the work of the other study groups in order to bring attention to technological advances in water resources development; and five task groups to serve as basic work groups concerned with specific resource categories such as flood control, navigation, and erosion.

A comprehensive plan specifically designed to involve the general public was prepared. The plan provided for development of channels of communication in order to furnish study information to the public and, in turn, obtain information concerning the setting of goals and the identification of both needs and problem areas. In order to establish this two-way communication, a number of measures were proposed and implemented.

For example, two series of public meetings have been held to date—the first in 1967 to announce initiation of the study and the second in 1976 to present information on study findings and to solicit the public's views and perceptions of problems and needs. Three major study reports have been released: *The Chesapeake Bay Existing Conditions Report*, the *Future Conditions Report*, and the *Impact of Tropical Storm Agnes on Chesapeake Bay*. Each report has been made available to representative libraries throughout Chesapeake Bay as well as through the National Technical Information Service of the Department of Commerce. A brochure describing the hydraulic model and the model testing program has also been published and distributed. A documentary film entitled "Planning for a Better Bay" was produced in 1973 and has been shown throughout the Bay region to a variety of organizations and groups. Hundreds of public presentations—many of them slide talks—have been given to civic, environmental, fraternal, professional, and political groups as well as business and trade associations by Baltimore Dis-



Chesapeake Bay Study—A Strategy for Public Participation.

trict staff on some aspect of the Chesapeake Bay.

In terms of informing the public about the model, tours have been conducted since the model dedication in May 1976. As a result, over 45,000 visitors from all over the world have toured the Kent Island facility. The public was also invited to attend both the groundbreaking and dedication ceremonies for the model. In addition, the model has been opened on weekends during Queen Anne's Day and Chesapeake Appreciation Weekend Celebrations. The public response during these weekend celebrations has been overwhelming.

All of the above techniques have proven useful in development of the study program. In addition, an informal liaison has been maintained with the Citizens Program for Chesapeake Bay, Inc., (CPCB), a Bay-wide umbrella organization for citizens groups with an interest in Chesapeake Bay and its resources. The CPCB has reviewed and commented on study program reports of both the *Existing and Future Conditions Reports*.

And where will the general public fit-in in the future? As the Chesapeake Bay Study enters its final phase, an even more intensive public involvement program is planned since the remaining work involves the formulation and recommendation of specific solutions to problems. *News Circulars* similar to this first issue will be distributed from time to time in order to keep you abreast of what's happening in the study. Several series of public meetings will be held throughout the Bay region to present information which should prove both interesting and useful to you. At these meetings, which are scheduled over the next four years, we will be asking for your response concerning such things as impacts, alternatives, and recommendations in connection with the High Flow, Low Flow, and Tidal Flooding Studies. But you will have other opportunities to become involved in this study: A series of workshops are scheduled to provide an opportunity for citizens to actually become involved in the planning process at several key points of the final study phase. Citizens attending these workshops will be asked to provide input during the formulation of alternative solutions to previously identified problems as well as in the selection of final recommendations.

As a result of the public response to model tours, new and improved visitors facilities are planned. Such facilities, which are likely to include a meeting room, exhibits, and professionally prepared tours, will constitute an important part of the Chesapeake Bay Study public involvement program in the future.

In addition to the above, the Baltimore District will continue employing means which it has used in the past—such as public presentations—in order to keep the public informed of the study.

Particular emphasis will also be placed on coordinating public involvement activities with those of other related Federal and state programs in an attempt to avoid duplication. Steps have already been taken to place articles in other organizations' newsletters to further disseminate important information on this study. Also under consideration is the use of established advisory committees to provide public input into this study program.

The means of informing you of the Chesapeake Bay Study and of assessing your needs with regard to the Bay have been established. Now it is up to you, the public, to help us better serve your needs.

FIRST IN A SERIES . . . .

This is the first in a series of News Circulars to be published by the Baltimore District to inform interested citizens of the Corps' Chesapeake Bay Study. Should you have any comments regarding the Study or this News Circular, we would appreciate hearing them. Send your comments to:

Chesapeake Bay Study Branch
Planning Division
U.S. Army Engineer District, Baltimore
P.O. Box 1715
Baltimore, Maryland 21203

or call

(301) 962-3410

ANYONE ELSE INTERESTED?

Do you know of anyone else who would like to receive information on the Study? If so, please give us their name. Also, do we have your correct name and address? If not, please fill out the form below and return the old mailing label.

Name ____________________

Address ____________________

City ____________________

State ____________________

Zip ____________________

Fold Here

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U. S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS
P. O. BOX 1715
BALTIMORE, MARYLAND 21203

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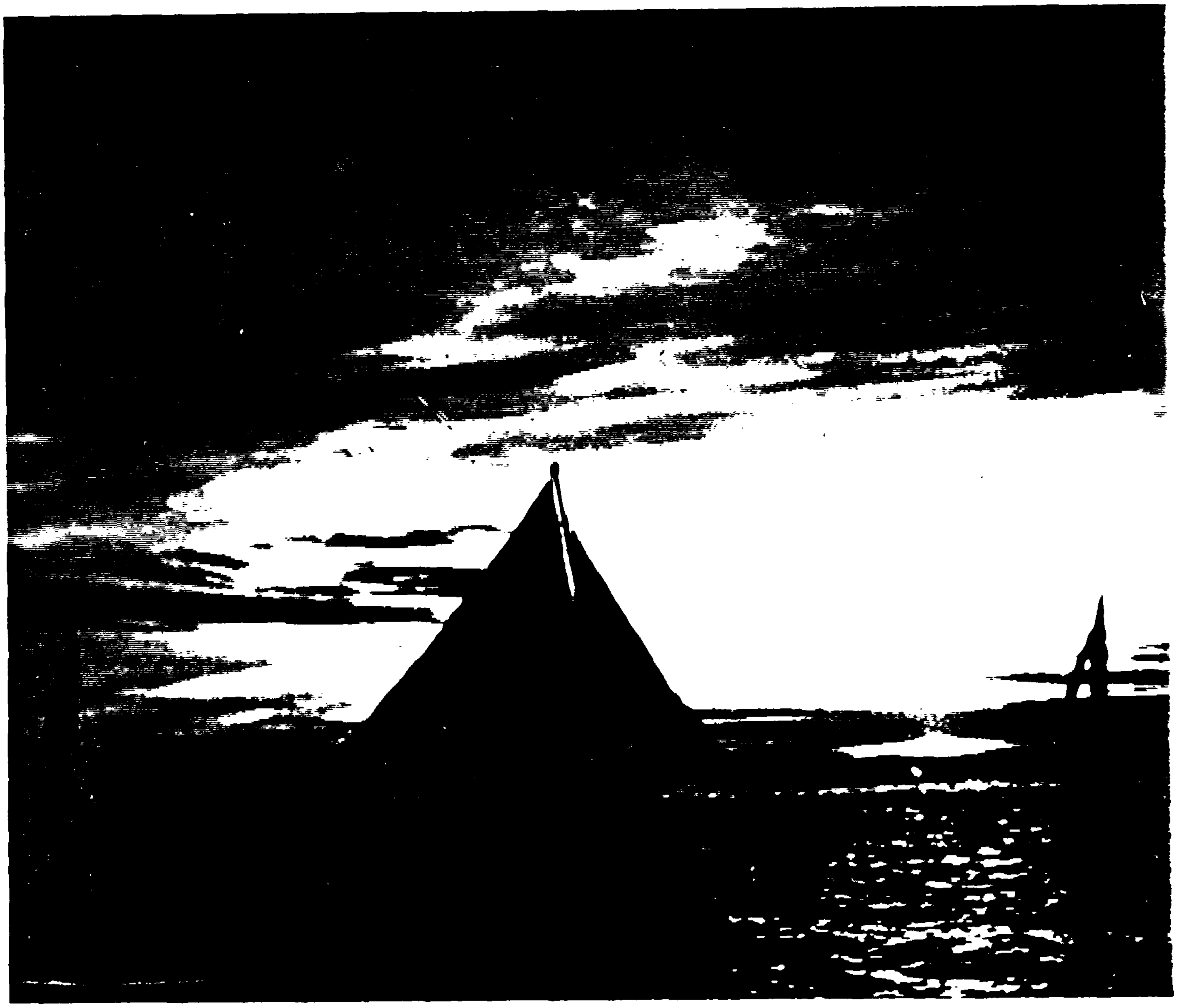
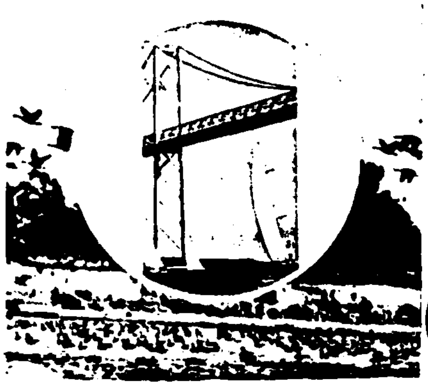
Chesapeake Bay, as a Vast Natural, Social, and Economic Resource Faced by Many Complex Problems, Requires a Combined and Coordinated Effort in order to Maintain Its Integrity.



CHESAPEAKE BAY STUDY
BALTIMORE DISTRICT
CORPS OF ENGINEERS



NEWS CIRCULAR

VOL. 2 OCTOBER 1979

CORPS CONDUCTING VARIETY OF TESTS ON HYDRAULIC MODEL

The Hydraulic Model of Chesapeake Bay is the world's largest estuarine model. The eight acre model, hand molded in concrete, was constructed in a warehouse type shelter covering 14 acres under roof. Contained also in the shelter is a water treatment plant for the model, the immense model tide generating system, and office trailers housing the model operating personnel. Built into the shelter is a complex utility system comprised of an extensive network of water supply piping and many miles of electrical wiring. A small electronic computer both monitors and controls a sophisticated instrumentation system that not only activates many model operations but acquires a significant amount of data from the model during hydraulic studies. In short, the Hydraulic Model of Chesapeake Bay is a finely tuned system, depending on the proper operation of its support system for effective accurate results.

Designed for comprehensive estuarine study capability, the Chesapeake Bay Model can be used in the analysis of many types of complicated tidal hydraulics problems not amenable at this time to solution by mathematical methods only. There are, however, hydraulic model studies planned that will combine both mathematical methods and the Chesapeake Bay Model.

Following the completion of the adjustment of the Chesapeake Bay Model, and verifying that, in fact, model hydraulic and salinity phenomena are in acceptable agreement with the prototype, the Corps of Engineers started on the Baltimore Harbor Study.

The overall objective of this study was to determine the hydrodynamic changes, if any, in the Chesapeake Bay system that would result from the proposed enlargement of Baltimore Harbor and its approach channels. As well as being a politically, economically, and environmentally sensitive undertaking, the proposed channel enlargement is also a significant construction project.

Continued on page 5

During damage surveys of flood-prone communities, information is collected on proximity of structures to the waterways.

TIDAL FLOODING STUDY UNDERWAY

The tidal flooding portion of the Chesapeake Bay Study is currently underway and will focus upon expected flood damages in the Bay Region as a result of storms such as occurred in August 1933 or during "Hazel" in October 1954. The final output of the study will be to determine if it is feasible to provide some form of flood protection for communities identified as "critically flood-prone" in the *Chesapeake Bay Future Conditions Report.*

Historically the Bay Region has been subject to damages from periodic tidal flooding. Unfortunately, accounts of these storms are poor and innundation elevations as well as damages were seldom recorded in sufficient detail to be useful for planning purposes. Also, since the 1933 storm, considerable development has occurred along the shoreline. Thus, damages sustained during a tidal flood today would be much greater than that of 1933.

The tidal flooding study, in seeking to both better identify and resolve the

flooding problem, has three primary objectives. First, to provide a better understanding of the tidal flood stage-frequency relationship in the Bay Region as a whole and also in those communities which are subject to tidal flooding. Second, to define the environmental and socio-economic impacts of tidal flooding in those communities subject to flooding. Finally, to recommend structural or non-structural tidal flood protection in those communities where it is found to be economically and environmentally feasible and socially acceptable.

An important first step in meeting these objectives is to conduct flood damage surveys in those communities which have been identified as flood-prone. These include:

Maryland	**Virginia**
Cambridge	Cape Charles
Crisfield	Chesapeake
Pocomoke City	Colonial Beach
Rock Hall	Fredericksburg
Smith Island	Hampton
Snow Hill	Norfolk
St. Michaels	Poquoson
Tilghman Island	Portsmouth
	Tangier Island
	West Point

During this past summer, the Corps initiated flood damage surveys in many of these communities. The type of information being collected in the surveys includes type of development (residential, commercial, or industrial), proximity of the structures to the waterway (both horizontally and vertically), and any information regarding historical damages and flood heights. A product of this data collection will be the development of a curve which relates damages to depths of flooding in each community. It should be noted that coordination with certain Federal and State agencies, to include the Federal Flood Emergency Management Agency, is being maintained at this point to avoid any duplication of effort and to share available data with the communities.

Future tidal flooding work efforts will center around the Hydraulic Model. A numerical tidal surge model will be used to develop stage-frequency information for the critical flood prone areas. The Hydraulic Model will be used to calibrate and verify the flooding portion of the numerical model by simulating several storm surges of different frequencies. The Hydraulic Model will also be used to investigate salinity problems associated with tidal surges and determine the time required for the salinity regimen to return to "normal".

The modeling work plus engineering, environmental and socio-economic studies will determine those communities where some form of flood protection is feasible. The final study report will then recommend authorization studies for those communities.

LOW FLOW STUDY EXAMINING THE EFFECTS OF REDUCED FRESHWATER INFLOWS TO THE BAY

The Bay's rivers provide the freshwater that controls the Bay's solinity regime. The Susquehanna is by far the most important source of freshwater.

The Corps of Engineers' Low Freshwater Inflow Study is a major component of the third and final phase of the Chesapeake Bay Study. The study has as its principal objectives to:

- provide a better understanding of the relationship between Chesapeake Bay salinities and the freshwater inflow from its tributaries.

- define the environmental and socio-economic impacts of both short and long-term reductions in freshwater inflow.

- recommend the minimum flows or flow schedules that should be maintained in the major tributaries in order to assure the integrity of Chesapeake Bay.

The study originated with the realization that Chesapeake Bay is dependent on the inflows of freshwater from its drainage basins to maintain its unique and highly productive aquatic environment. The health of the ecosystem is not only important to the commercial and recreational fishermen who harvest the Bay's products, but it carries further to the very social and economic fabric of the entire Bay Area.

The importance of the Bay's biological health is reflected in the principal focus being given the biological investigations phase of the Low Flow Study.

Substantial effort during the Low Flow Study, to date, has been directed toward the biological assessments program. The Baltimore District, working with the U.S. Fish and Wildlife Service and the Bay Study's Fish and Wildlife Coordination Group (an advisory group of concerned agencies and Bay scientists), reached agreement on the basic study assessment approach to be used. Because of the realized complexities inherent in an evaluation of a natural system as large and complex as the Chesapeake Bay, it was also agreed that a contractor should be used to conduct the biological assessment. Western EcoSystems Technology (WESTECH) was subsequently awarded that contract.

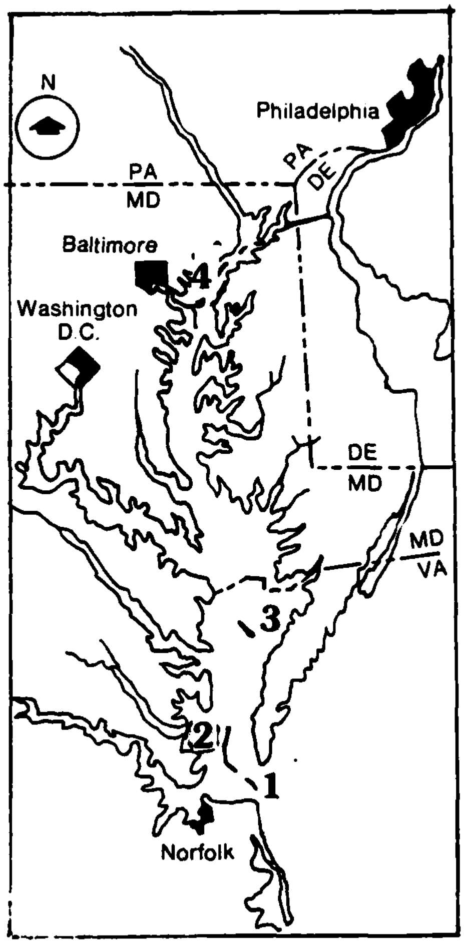
The output of this effort, due to be completed toward the middle of 1981, will provide two major products:

• a definition of Bay health and productivity in terms of those aspects of the estuarine system which contribute to the social, economic, and environmental well being in the Bay area.

• an assessment of the biota related change accompanying reduced freshwater inflows.

A major portion of the biological work to be done will be based on the results of testing on the Hydraulic Model of Chesapeake Bay. Hundreds of thousands of pieces of information will be collected in the hydraulic model tests for low flow. A sizeable effort on the part of WESTECH will be required to assimilate, organize, and evaluate this large mass of data into a meaningful and useful base for the decision making process. The model testing program will provide data on the salinity and current velocity changes that occur due to both historical and projected future low freshwater inflow conditions.

More intensive discussion of study methodology as well as study progress updates will be provided in future editions of the *Chesapeake Bay Study News Circular*.



The Baltimore Harbor Channel project involves the enlargement of channels in four distinct areas of the Bay.

Continued from page 1

Briefly, the overall Baltimore Harbor Channel project involves the deepening of the existing channel system from 42' to 50' in depth. This will be done, as shown on the adjoining map, in four distinct areas of the Bay, including:

1. The Cape Henry Channel

2. The York Spit Channel

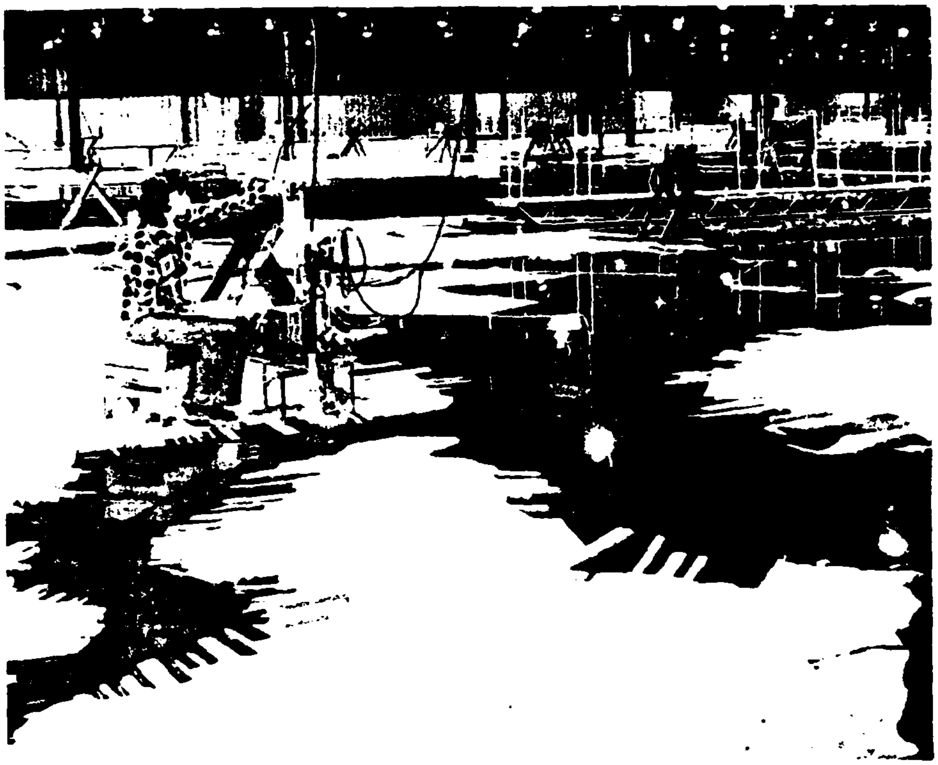
3. The Rappahannock Shoals Channel

4. The Baltimore Harbor Approach Channels.

The testing work on the hydraulic model was done in two phases, as follows:

— First, a Base Test to establish benchmark salinity and current velocity conditions in the model. At the conclusion of the Base Test the existing 42' channels were removed from the model and the proposed 50' channel was constructed in its place.

— Following the installation of the proposed new channel in the model, operating personnel completed the Plan Test. The Plan Test established salinity and current velocity conditions that resulted from the new construction.



The purpose of the Baltimore Harbor Test was to determine hydrodynamic changes in the Bay resulting from enlargement of Baltimore Harbor and its approach channels.

During both the Base and Plan Tests, salinity and current velocity data were collected at 69 stations throughout the model. At the same time, continuous records of water surface elevations were collected at 10 stations throughout the project area for automated model control as well as study purposes. Data collection and reduction on a model the size of the Chesapeake Bay Model is an enormous task in itself. For instance, during the 110 days of model test operation time, 40,000 salinity and 3200 velocity samples were collected. These data were reduced, tabulated, and painstakingly plotted in graphical form for later analysis by environmental planners, engineers, and scientists.

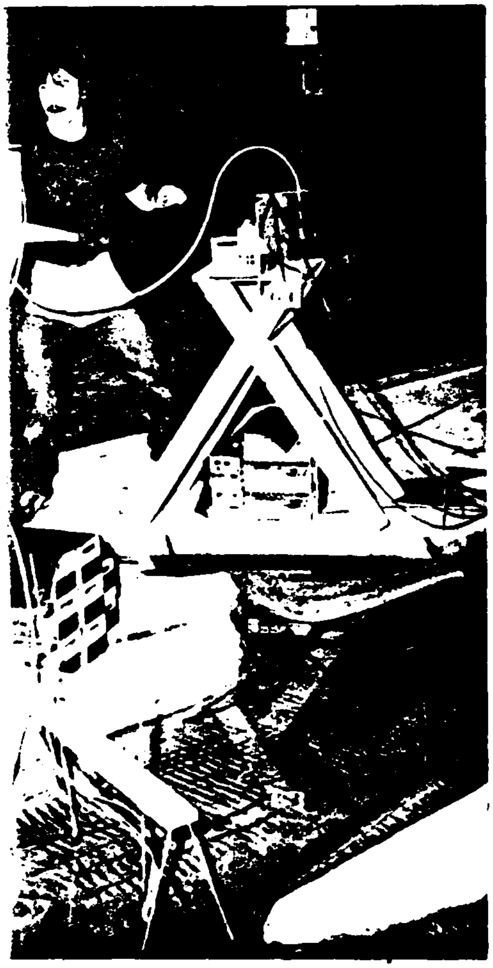
Primarily, the analysis of the results of this study is divided into two units of work:

— Data from both the Base and Plan Tests are compared for change resulting from the channel enlargement.

— Noted hydrodynamic and salinity changes then undergo further analysis to determine the total physical impact on the system.

As of this time, the analysis of the results of the Baltimore Harbor Test is still underway. Preliminary evaluation of the Baltimore Harbor Hydraulic Model Test reveals little or no change in velocities throughout the Bay or salinity patterns in the Bay below the confluence of the Potomac River, as a result of channel deepening. Above the Potomac River, however, salinity changes have been recorded and appear to be localized in the channel sections entering and in the Patapsco River. In general, surface salinities become fresher and bottom salinities become saltier with channel deepening. An in-depth analysis and evaluation of test results is currently ongoing.

Following the sinking of the U.S. Coast Guard Cutter Cuyahoga on 20 October 1978, the Director of the



The Potomac River Estuary Test is designed to explore the ramifications of using the estuary as a supplemental source of water supply.

Chesapeake Bay Hydraulic Model received a request from Coast Guard officials to conduct a test on the model to determine the approximate location where the bodies of those victims on board the Cutter would likely surface. A dye was injected into the model along with a group of floats in the area where the Cuyahoga sank and several tidal cycles were run. Based on the dispersion of the dye and floats, it was possible to indicate the likely boundaries or "envelope" within which the bodies could expect to be found. Within several days of the model test, the remaining bodies were, in fact, found where the model test had indicated they would be.

In the middle of March, work was started on the Potomac River Estuary Water Supply and Wastewater Dispersion Study. The objectives of the test are to define the wastewater dispersion patterns and salinity regimes in the Potomac Estuary under several freshwater inflow conditions and to explore the ramifications of using the Potomac River Estuary as a supplemental source of water supply for Washington, D.C. One of the concerns generated by using the estuary as a source of water supply is the possibility of recycling wastewater into the public water supply during periods of low freshwater inflow into the estuary, and the possibility of change in the salinity levels and the circulation patterns in the upper estuary of the Potomac.

During this test the wastewater discharges from the sewerage treatment plants in the Upper Potomac Estuary were simulated by scaled down discharges of a fluorescent dye solution into the model. Samples of water drawn from the model at predetermined times and locations were analyzed for dye concentration. These data indicate how the simulated wastewater discharges in the model disperse over time.

To accomplish the objectives of the Potomac River Estuary Test, model work is being done in two phases. Phase I explored the existing conditions in the Potomac River Estuary, defining both salinity and wastewater dispersion patterns, during different freshwater rates of flow into the estuary. Phase II of this study will define salinity and wastewater dispersion patterns to be expected by the year 2020 during periods of low freshwater inflow, and the effects of pumping from the estuary for the Washington, D.C. water supply. The data collected during each phase of this study will be analyzed to determine if, in fact, there are any significant changes in salinity or the dispersion of wastewater that would be due to pumping water from the upper portion of the estuary for water supply purposes.

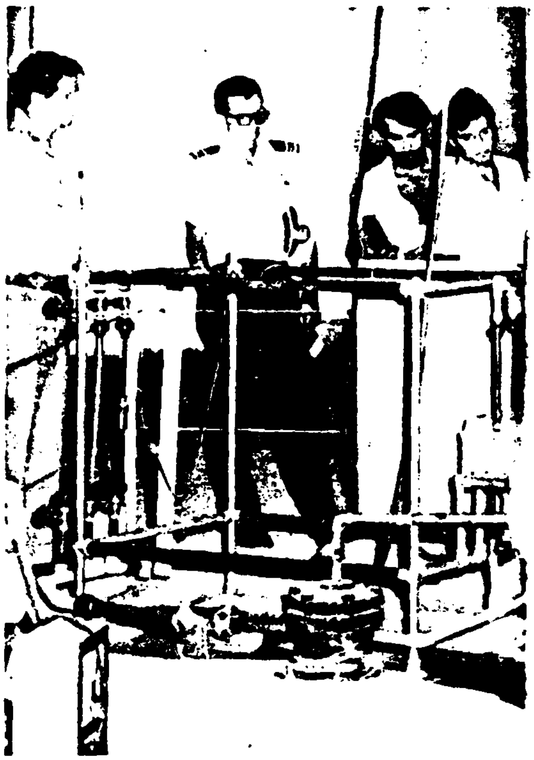
A significant part of this study will be the application of mathematical methods to describe certain water quality aspects of the Potomac River

Estuary. Data taken from the hydraulic model will be used to calibrate an existing water quality mathematical model of the Potomac River Estuary. This mathematical model will be used to determine the change in concentration over time of various measures of estuarine water quality at specific points of interest under various flow schemes and pumping rates.

Early in February 1979, the Office of the Chief of Engineers requested that tests simulating oil spills resulting from ship collisions or refinery leaks be conducted on the Chesapeake Bay Model. These tests were done to provide information about the probable dispersion by tidal currents of oil spills in the entrance to Chesapeake Bay and in the Hampton Roads Area of Virginia.

Five spills, ranging in magnitude from an instantaneous spill of 7000 barrels of crude oil to 500,000 barrels of oil discharged over a twelve hour period were simulated by injecting appropriate volumes of crude oil into the model. The dispersion of the oil in the model was recorded over time by both visual inspection and by a bank of ten cameras simultaneously photographing the area of interest from above the model at specified times during successive tidal cycles. This information was then forwarded to the Office of the Chief of Engineers where it was used in the evaluation of a permit for an oil refinery proposed for the Hampton Roads area.

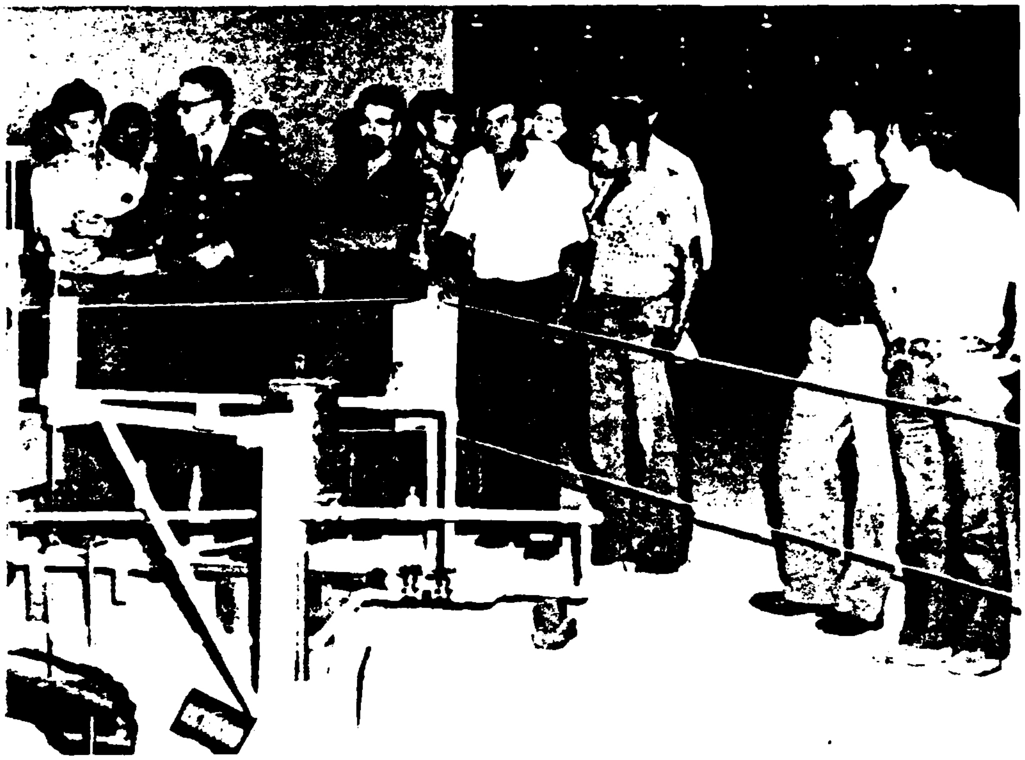
Testing, to date, has shown the model to be a useful tool to the water resource planner, engineer, and scientist in better understanding both natural occurrences as well as the effects of proposed structural and management programs. The model should also prove valuable during the testing program planned for the next two years.



Since May 1976, approximately 65,000 people have toured the Chesapeake Bay Hydraulic Model at Matapeake.

CHESAPEAKE BAY HYDRAULIC MODEL CONTINUES TO DRAW LARGE NUMBERS

Since it was opened to the public in May, 1976, the Chesapeake Bay Hydraulic Model, located at Matapeake, Maryland on Kent Island, has attracted approximately 65,000 visitors from across the United States as well as many foreign countries. The model is one of the most useful scientific tools available to the engineer, scientist, and water resources planner in providing a better understanding of the problems and conflicts which beset Chesapeake Bay. The model reproduces to a manageable scale phenomena that occur throughout this large and complex estuarine system



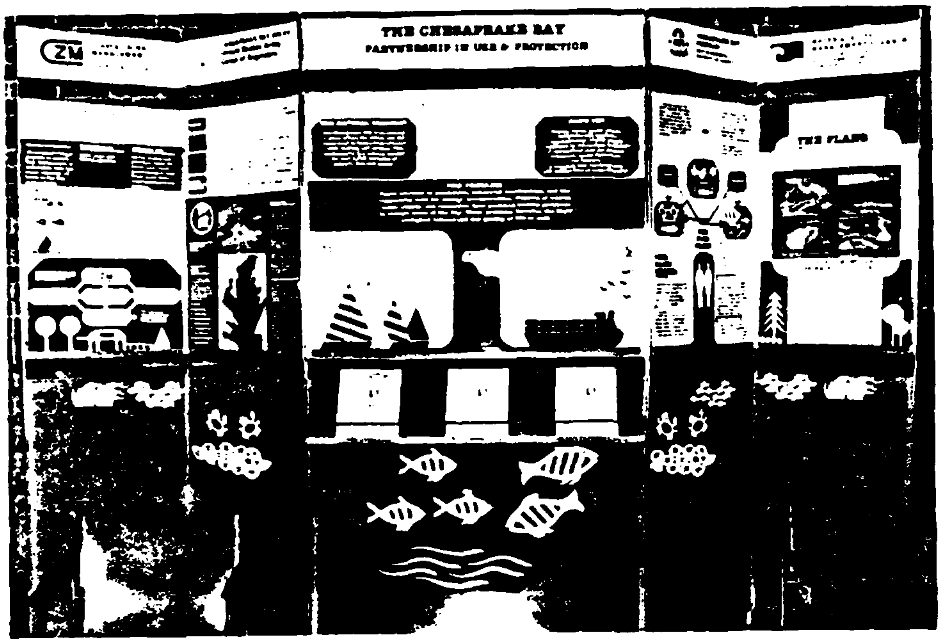
including tides, currents, changes in water temperature, salinities, and the dispersion of sediment and dyes. The model, which covers an area of eight acres, is made of molded concrete and holds approximately 450,000 gallons at mean low water. Limits of the model include the entire Chesapeake Bay and tributaries to the head of tide and the surrounding land area to an elevation of 20 feet above mean sea level. The model is housed in a shelter 1,080 feet long and 680 feet wide.

Model tours, which include both a slide presentation and a walking tour around the model, are provided five days a week, Monday thru Friday except Federal holidays. The public is welcome! To reach the model, take U.S. Route 50 to Kent Island. Proceed south on State Route 8 off of Route 50 approximately 2½ miles to the model facility on the right. For more information on the tours or to make arrangements for groups of 10 or more people, please call our Public Affairs Office at (301) 962-4616.

See Our New Visitors Center

We have good news for visitors to the Chesapeake Bay Model. It is no longer necessary to brave the winter cold and summer heat of the Chesapeake Bay Model Shelter during your stay, as the brand new climate controlled visitors center has been completed by our contractor, the J. F. Snyder Company.

Don't expect to see the visitors center as you park your car, for the facility is built inside the model shelter. A short stroll along the beautiful trees and shrubs donated and planted last year by the Kent Island Garden Club will lead to the new double door entry especially designed to accommodate the handicapped. While waiting for the tour to begin, spend a few minutes in the display area learning about the Chesapeake and the Corps of Engineers' efforts to preserve and enhance it.



The Chesapeake Bay Exhibit demonstrates how certain Federal and State programs are in partnership in their efforts to use the Bay while providing for its protection.

CHESAPEAKE BAY EXHIBIT DEMONSTRATES THE COOPERATIVE EFFORTS OF BAY PROGRAMS

The Baltimore District, together with several other Federal and State agencies conducting Chesapeake Bay related programs and studies, have been involved in a joint effort to produce an exhibit dealing with the Bay. The exhibit, entitled "The Chesapeake Bay — Partnership in Use and Protection", describes the Corps' Chesapeake Bay Study, the Environmental Protection Agency's Chesapeake Bay Program, the Maryland and Virginia Coastal Zone Management Programs, and the Maryland and Virginia 208 Water Quality Management Programs.

The exhibit is an informative, free-standing structure. The center panel illustrates the conflicts which arise between the Bay as a natural resource and man's use of it. Each of the side panels is devoted to a description of the program or study which the respective Federal or State agency is conducting. The exhibit demonstrates how these programs are in partnership in their efforts to use the Bay while providing for its protection.

The Chesapeake Bay Exhibit is available for use by agencies, local governments, libraries, and private organizations at no charge. To arrange for display of the exhibit, you may call either Fran Flanigan, Citizens Program for the Chesapeake Bay, Inc., (301) 377-6270; Harry Stone, Delmarva Advisory Council, (301) 742-9271; or Kitty Cox, Conservation Council of Virginia Foundation, (804) 769-2722.

Your Response Has Been Good...

This is the second in a series of News Circulars to be published by the Baltimore District to keep the public informed of the Corps' Chesapeake Bay Study. We received favorable response from the public on our first News Circular. We continue to encourage your response and comments regarding both the Study and this publication. Send your comments to:

Chesapeake Bay Study Branch
Planning Division
U.S. Army Engineer District, Baltimore
P.O. Box 1715
Baltimore, Maryland 21203

or call

(301) 962-3410

Detach this sheet from News Circular, fold here and return to above addressee.

ANYONE ELSE INTERESTED? Do you know of anyone else who would like to receive information on the Study? If so, please give us their name. Also, do we have your correct name and address? If not, please fill out the form below and return the old mailing label.

Name ______________________________

Address ______________________________

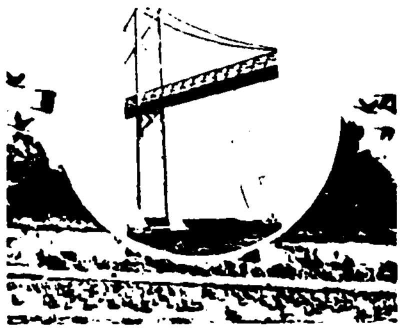
City ______________________________

State ______________________________

Zip ______________________________

In accordance with the Privacy Act of 1974 and 10 USC 3012, routine uses of the information extracted from this form will enable the Corps of Engineers to send public information about the Study to persons on the mailing list. All information is voluntary.

CHESAPEAKE BAY STUDY
BALTIMORE DISTRICT
CORPS OF ENGINEERS



NEWS CIRCULAR

JUNE 1983

Study to be Completed Next Year

The report on the Chesapeake Bay Study and Hydraulic Model is scheduled to be published in October 1984. By that time, we will have completed the hydraulic model tests, analytical studies and socio-economic assessments necessary to meet the objectives of the study. These objectives were to:

1. Assess the existing physical, chemical, biological, economic and environmental conditions of the Chesapeake Bay and its water resources.
2. Project the future water resource needs of Chesapeake Bay to the year 2020.
3. Formulate and recommend solutions to priority problems using the Chesapeake Bay Hydraulic Model.

The first objective of the study was met in 1973 when the **Chesapeake Bay Existing Conditions Report** was published. This report presented a detailed inventory of the Chesapeake Bay and its water related resources. Divided into a summary and four appendices, the report presented an overview of the bay area and the economy; a survey of the bay's land resources and its use; and a description of the bay's life forms and hydrodynamics.

The purpose of the **Future Conditions Report,** published in 1978, was to provide a format for presenting the findings of the second phase of the Chesapeake Bay Study. Satisfying the second objective of the study, the report describes the present use of the resource, presents the demands to be placed on the resource to the year 2020, assesses the ability of the resource to meet future demands, and identifies general means to satisfy the projected resource needs.

In June 1972, the Chesapeake Bay Basin was subjected to one of the most devastating storms the region has ever witnessed—Tropical Storm Agnes. The massive amounts of freshwater, sediment and other pollutants that entered the bay as a result of this storm caused considerable environmental and economic damage to the bay. Because of the size of the storm and the resulting damage, a study was performed by the Corps and in October 1975, a report entitled **Impact of Tropical Storm Agnes on Chesapeake Bay** was published. The purpose of this study was to determine and document the effects of the storm on the Chesapeake Bay estuarine system and to locate any changes in the bottom geometry and determine if these changes were of sufficient magnitude to warrant a change in the design of the hydraulic model.

Each of the above reports has been made available to representative libraries throughout the area as well as through the National Technical Information Service of the Department of Commerce.

The completion of the **Future Conditions Report** marked the end of the second phase and the beginning of the third and final phase of the Chesapeake Bay Study, namely, the formulation of solutions to high priority problems. The two problems which are being studied are those associated with flooding caused by hurricane type storms (tidal flooding) and those resulting from the projected decrease in the amount of freshwater flowing into the Chesapeake Bay from its tributaries (low freshwater inflow). Each of these problems is discussed in further detail in subsequent articles in this circular.

The final product of the Chesapeake Bay Study will consist of a summary report as well as a main report and set of appendices on both the Low Freshwater Inflow Study and the Tidal Flooding Study. The summary report will be a review of the **Existing Conditions Report, Future Conditions Report, Tropical Storm Agnes Report** and highlights of the Low Freshwater Inflow and Tidal Flooding studies. It will also describe the public involvement program and

Notice

Model Closing Delayed

At the time of printing, the closing of the model had been suspended for 2 months to allow time for a task force appointed by Congressman Roy Dyson to find alternative sources for funding the facility. During this delay, tours of the model will continue. If no sources are found by July 15th, the closing operations will be continued and the tours terminated.

the history of the Chesapeake Bay Model and associated testing program.

The final report is scheduled to be published in October 1984.

The Chesapeake Bay Low Freshwater Inflow Study

One of the major problem areas being investigated under the Chesapeake Bay Study is low freshwater inflow. This study has stemmed from the concern over the increasing use of water from the bay's riverine tributaries. A portion of the water that is withdrawn for municipal, industrial, and agricultural purposes is used consumptively and, therefore, never returns to the river. The amount that is consumed varies depending upon the use. For instance, 10 to 25 percent of the water withdrawn by a municipal system is never returned to the tributary. Irrigation losses can be as high as 75 percent. Based on projections made to the year 2020, these losses could reduce, by as much as 35 percent, the amount of freshwater that flows into the bay from its major tributaries. This will increase the salt levels in Chesapeake Bay and, consequently, could have an adverse effect on its aquatic life and other environmental and socio-economic values.

The major objectives of this study are to:

1. provide a better understanding of the relationship between Chesapeake Bay salinities and the freshwater inflow from its tributaries.
2. define the biological, environmental, social and economic impacts of both short and long term reductions in freshwater inflow.
3. recommend the minimum freshwater inflows from the major tributaries that should be maintained in order to assure the integrity of Chesapeake Bay.

In order to assess how salinities would increase during periods of low freshwater inflow and secondly, how consumptive losses would affect salinities, a Problem Identification Test was performed on the Chesapeake Bay Model. The four conditions simulated during the test were 1) Base Average which represented long term average freshwater inflows, 2) Base Drought which was a simulation of the 1960's drought, 3) Future Average which simulated the long term average flows reduced by the projected consumptive losses for the year 2020, and 4) Future Drought which was a representation of the 1960's drought reduced by the same consumptive losses.

The test was completed in March 1980 and the results were documented in Technical Report HL-82-3, entitled **Low Freshwater Inflow Study.** This report was prepared by the U.S. Army Engineer Waterways Experiment Station and published in January 1982.

One of the major factors contributing to the importance of the bay is its biological health. The health of the ecosystem is not only important to the commercial and recreational fishermen who harvest the bay's products, but it carries further to the very social and economic fabric of the entire bay area.

In this regard, a contract was awarded in 1979 to Western Eco-Systems Technology, Inc. (WESTECH) to develop a methodology and establish a baseline for the determination of biological changes caused by reduced freshwater inflows. This methodology focused on the potential change in habitats rather than populations of aquatic life. During the development of the methodology, 55 representative Chesapeake Bay species were selected for study. Four major parameters were used to define the potential habitat for each organism. These were salinity, depth, substrate and dependence on other species. Based on these parameters, the potential habitat for each of the 55 species was mapped for each of the four scenarios from the hydraulic model test. By then measuring the area for each organism for each scenario, the change in habitat could be determined.

The final report prepared by WESTECH on the biological assessment of low freshwater inflows was published in May 1982 and is now available through the National Technical Information Service.

Following the completion of the biological assessment, the Fish and Wildlife Service convened an ad hoc committee composed of eminent bay scientists. The purpose of this committee was to provide scientific judgment and experience in a group concensus evaluation of the effects of reduced freshwater inflows on the bay's aquatic life and the overall ecosystem. Using the findings from the WESTECH study, members of the committee interpreted what the changes in habitat meant in terms of impacts on the species and how this might possibly affect the population of each. Their recommendations will be used in the formulation of the alternative plans.

The social and economic impacts of reduced inflows on those who use the bay and its tributaries will also be assessed. This includes the effects of increased salinities on municipalities and industries who withdraw water from the system as well as those who use the estuary to earn their livelihood, such as commercial fishermen or those who use it for recreational purposes such as swimming and fishing.

In conjunction with the biological and socio-economic assessments, an institutional analysis is being done to survey the existing political, legal and financial climate as it relates to possible implementation of inflow recommendations for the major bay tributaries. This analysis will focus primarily on the riverine portions of the bay's tributaries.

Presently, the extent of the problem caused by reduced freshwater inflows is being analyzed. The next step will be to array the alternative solutions to mitigate these problems. Finally, the impacts of these alternatives will be analyzed and then all alternatives screened in order to select the most promising solutions.

The final report on the Low Freshwater Inflow Study will contain an assessment of the socioeconomic and environmental consequences of reduced freshwater inflows to Chesapeake Bay and an identification of the most promising alternative solutions to the problems caused by these flow reductions.

Tidal Flooding Study in Final Stage

Since man first settled on the shoreline of Chesapeake Bay, he has been subject to periodic tidal flooding. This has resulted in immeasurable human suffering and millions of dollars of property damage. Serious tidal flooding in the Chesapeake Bay Region is caused by either hurricanes or "northeasters." The Tidal Flooding Study, in seeking to both better identify and resolve these flooding problems, has three primary objectives. First, to provide a better understanding of the tidal flood frequency relationship in the bay region with particular emphasis on those communities which are subject to tidal flooding. Second, to define the environmental and socio-economic impacts of tidal flooding in these floodprone communities. Finally, to recommend structural or nonstructural tidal flood protection in those communities where it is found to be economically and environmentally feasible and socially acceptable.

The first step in the study was to identify all communities with a population of 1000 or more that were located within the tidal flood plain. The next step was to identify those communities that were floodprone. In order to be classified as "floodprone", at least 50 acres of land that were developed for intensive use had to be inundated. In the next step, all communities in which 25 acres of intensively developed land would be inundated by the 100-year tidal flood were classified as "critically" floodprone. The final screening eliminated those communities where it was evident that flood protection would not be feasible. Based on the above analyses, 18 communities were identified as being critically floodprone and in need of more detailed study. These were:

Maryland	Virginia
Cambridge	Cape Charles
Crisfield	Chesapeake
Pocomoke City	Colonial Beach
Rock Hall	Fredericksburg
Smith Island	Hampton
Snow Hill	Norfolk
St. Michaels	Poquoson
Tilghman Island	Portsmouth
	Tangier Island
	West Point

For each of the 18 communities, flood damage surveys were first conducted. This informatoin was needed to establish the amount of damages that would occur in each of the communities for various types and degrees of tidal floods. The next step was to look at an array of alternative structural and nonstructural measures that would mitigate the damages for each community. After determining what measures would be appropriate in each community, the environmental and socio-economic impacts of each were assessed.

A more detailed screening of these floodprone communities is now being performed and the reconnaissance studies based on more refined environmental, economic, social and hydrologic data are being completed. The last step will be to formulate and evaluate the flood damage reduction alternatives for each community.

The final report of the Tidal Flooding Study will provide a preliminary analysis of the feasibility of providing structural and nonstructural protection for floodprone communities. It will also contain recommendations for studies required before Congress can authorize a project, in those communities where some form of flood protection is found to be economically and environmentally feasible and socially acceptable.

Chesapeake Bay Model Closing

Early in April work began on closing the Chesapeake Bay Model. By mid-summer, most of the equipment will have been removed from it and the building will be secured to protect it from vandalism.

The Chesapeake Bay Model has been a very powerful and valuable tool. The insights to Chesapeake Bay that have been gained through its use could not have been gotten any other way. This was demonstrated even before the formal testing program on the model began. In order to calibrate and verify the model, data on tides, velocity and salinity were collected from the real bay. This was the most comprehensive prototype data collection program in the history of the Chesapeake Bay region. These data, together with the testing conducted in order to verify the model, uncovered several phenomena and problems of which the serious students of the bay were unaware. For example, the data provided new insights into the role of wind and estuarine circulation. Further, the model provided a new perspective relative to the transfer of water through the C&D Canal. This new perspective brought into question many of the previous assumptions on the net flow through the canal. Lastly, data from the verification test demonstrated the importance of the variations in both tidal cycles and freshwater inflow in establishing the salinity structure of the system.

The tests done on the model have proven equally valuable. Because of the availability of data from these tests, it has been possible to proceed with planning for projects with a full knowledge of the hydrodynamic changes which may be involved. Some of the more important of these tests were:

■ Baltimore-Harbor Channel Enlargement Test

Congress has authorized deepening of the channels leading to the Port of Baltimore from 42 to 50 feet. The purpose of this test was to ascertain if this deepening would cause any changes in the salinity regime and current patterns in Chesapeake Bay that would result in significant adverse environmental impact. Data from this test were used in the preparation of the environmental impact statement for the channel deepening project.

■ Nanticoke River Toxic Material Dispersion Test

This test was done at the request of the State of Maryland. Apparently, state officials were concerned over the possible environmental consequences should the toxic material stored at Sharptown, Maryland, somehow enter the Nanticoke River. The purpose of this test was to determine the dispersion of the toxic materials if a portion of them were spilled into the river.

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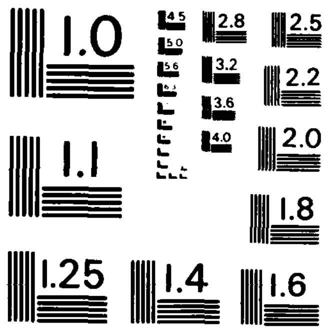


MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

■ **Hampton Roads Oil Dispersion Test**

The data from this test were input to the environmental assessment for the Hampton Roads Oil Refinery Permit Application. The purpose of this test was to define the dispersion of oil should there be a tanker collision or should the oil be spilled while being unloaded.

■ **Low Freshwater Inflow Problem Identification Test**

This test was performed in connection with the Low Freshwater Inflow Study. Its purpose was to determine the changes in salinity caused by decreased freshwater inflows during a reoccurrence of the 1960's drought as well as under conditions of average freshwater inflow. The data from the tests are being used to ascertain if the decreased inflows will have an adverse effect on the bay's aquatic life and to develop plans to mitigate these adverse effects.

■ **Potomac Estuary Water Supply and Wastewater Dispersion Test**

This test was performed for the Washington Metropolitan Water Supply Study. Its purpose was to explore the ramifications of using the Potomac River Estuary as a supplemental source of water supply for the Washington Metropolitan Area during periods of drought. Major concerns were whether or not salt water or the pollution plume from the 16 sewage treatment plants on the Potomac would reach the water supply intakes.

■ **Norfolk Harbor Channel Deepening Test**

This test was performed for the Norfolk District, Corps of Engineers. Its purpose was to determine the changes in the salinity regimes and current patterns caused by deepening the channels into Norfolk Harbor to 55 feet. The data from the test are being used to prepare the environmental impact statement for this project.

In addition to these major tests, several other smaller tests were conducted. Included were the Cuyahoga Victim Recovery Test for the Coast Guard, the Patuxent and Chester rivers prototype survey and Environmental Studies, the Lafayette River Waste Water Dispersion Test for Old Dominion Univeristy and the Air Florida Debris Recovery Test, which was done in conjunction with the rescue efforts for the Air Florida airplane accident.

Many of the more urgent problems of Chesapeake Bay were addressed in this program. The tests needed to complete the Low Freshwater Inflow and Tidal Flooding studies have been completed and we are able to finish the Chesapeake Bay Study without the need for any further testing on the model. In addition, in the time since the Norfolk Harbor Test was completed in the summer 1981, the model has been maintained so as to be available to other agencies and the scientific community to accommodate their testing needs. This maintenance has been expensive, costing over $55,000 per month. At this time there are no prospects for a large testing program.

Tours of Chesapeake Bay Model to End in May

Seven years and 120,000 visitors later, the visitors program at the Chesapeake Bay Hydraulic Model at Matapeake is drawing to a close. In May of this year, the last mile long tour will be taken around the 8-acre replica of the bay.

From May 1976, when the model was first dedicated, until September 1979, visitors had to brave either the cold of winter or the nearly 100 degree temperature during the summer as they sat in the unheated model shelter waiting for and watching the 20 minute slide presentation that preceded the tour. In 1979, however, the Corps completed a climate controlled visitors center which allowed people to become acquainted with the project in comfort. The center was constructed within the shelter that houses the model and consisted of an exhibit area and a large meeting room that could seat up to 150 people. While visitors waited for the tour to begin, they could spend time in the display area viewing the exhibits and becoming more familiar with Chesapeake Bay and the Corps of Engineers' efforts to preserve and enhance it.

During the slide presentation, visitors were informed of the work being done in the district to solve the problems of the bay and the important role that the model was playing in helping to solve these problems. After the presentation, a tour guide would escort them on a simulated 600 mile walk down to the Capes, around the Atlantic Ocean, up the eastern shore, across the C&D Canal and the Susquehanna River, down past Baltimore Harbor and the Washington Monument on the Potomac, and back to their starting place near Richmond. While on the tour, people learned to appreciate the vast size and importance of this valuable resource. Not only could they become acquainted with some of the various points of interest around the bay and their location, but more importantly, they could be educated on its physical processes, what lives in it, its values and how we use it. The model has given people the opportunity to learn about some of the physical processes such as the rise and fall of the tide and to place in perspective the entire form of the bay.

The visitors programs at the Chesapeake Bay Model has been an important tool in the Public Involvement Program of the study. It has given us the opportunity to reach and inform a much larger portion of the public than would otherwise have been possible. This has been one of the many benefits of having a place available where those who are interested in the bay could come and learn more about it and what the Corps is doing to preserve and enhance it.

To those who visited the Chesapeake Bay Model during the past 7 years, we hope that you enjoyed it and that your visit was both fruitful and enlightening.

CHESAPEAKE BAY STUDY
BALTIMORE DISTRICT • CORPS OF ENGINEERS

NEWS CIRCULAR

VOLUME 3 JUNE 1984

Study Summary

The report on the Chesapeake Bay Study will be published in October 1984. The draft report is currently undergoing a review by higher authority and other involved public agencies and the public. The final report will be forwarded to the U.S. Congress. Copies of the report will be placed in designated public libraries as well as the libraries of educational institutions in the Chesapeake Bay region. A copy of the report can be obtained from the Baltimore District next fall for the cost of reproduction.

The culmination of many years of work, this document reports on the comprehensive study effort required to meet the following stated objectives of the Chesapeake Bay Study:

1. Assess the existing physical, chemical, biological, economic and environmental conditions of Chesapeake Bay and its water resources.
2. Project the future water resource needs of Chesapeake Bay to the year 2020.
3. Formulate and recommend solutions to priority problems using the Chesapeake Bay Hydraulic Model.

The first objective of the study was met in 1973 when the ***Chesapeake Bay Existing Conditions Report*** was published. Divided into a summary and four appendices, this report presented, in considerable detail, an overview of the Bay area and economy, as well as a survey of its water and land resources, and a description of its biota and hydrodynamics.

The publication of the ***Future Conditions Report*** in 1978 satisfied the second objective of the study. This report not only described the present use of the resource but presented the demands then anticipated to be placed on the resource to the year 2020, assessed the "system's" ability to meet the future demands, identified existing and potential future problems and conflicts, and outlined general means to satisfy the resource needs.

Tropical Storm Agnes, occurring during June 1972, subjected Chesapeake Bay to massive amounts of freshwater, sediment and other pollutants. A report published in October 1975 documented the effects of this storm on the estuarine system.

With the exception of the ***Tropical Storm Agnes Report,*** each of the above reports have been deposited in representative libraries in the Chesapeake Bay area. They have also been stored in the archives of the National Technical Information Service.

The publication of the ***Future Conditions Report*** marked both the achievement of the second study objective, and the beginning of work on the third and final study objective: the formulation of solutions of priority problems. One of the major problem areas in Chesapeake Bay investigated during this third study phase was the physical and biological impact on the estuarine system of depressed freshwater inflow. Of concern was not only low flows due to long-term periods of drought, but also the additive effects of consumptive losses due to steadily increasing municipal, industrial and agricultural use of water from the many rivers tributary to the estuary. For instance, our studies show that estimated consumptive losses for the year 2020 could further reduce drought flows, thereby increasing the salinity an amount sufficient to adversely affect aquatic life in the Bay.

The Low Freshwater Inflow Test on the hydraulic model provided the data to determine how salinity in the system varied between long-term average inflow and drought flows. In turn, these salinity data were used in estimating the potential ecological impact on aquatic life in Chesapeake Bay. The results of the analysis of both salinity and biological data are examined in more detail in the article on the Low Freshwater Study.

The other major problem investigated during this third and final portion of the Chesapeake Bay Study was tidal flooding. Tidal flooding, induced by both hurricanes and northeasters, periodically inundates the low lying margins of the Bay. This flooding has, over the years, caused millions of dollars in damage, as well as privation and inconvenience to those living in flood prone areas.

By screening flood prone areas, those communities susceptible to serious flooding were identified, and studied further to determine the extent of damage, and the feasibility of both structural and non-structural flood damage mitigation measures. Structural flood protection measures include, for example, the construction of flood walls or levees, while non-structural measures include regulatory actions prohibiting the occupation of flood prone areas, flood proofing of structures, and the development of early warning or evacuation systems to protect life and property.

Of the 60 communities analyzed during this study, six were recommended for future detailed survey scope study. The work done in developing the conclusions and recommendations of the tidal flooding study is examined in further detail elsewhere in the brochure.

Low Freshwater Inflow Study

The Low Freshwater Inflow Study investigated in detail the effects of projected future depressed freshwater inflow on physical and biological aspects of Chesapeake Bay. The many aquatic species that live in the Bay, either permanently (e.g., oysters) or temporarily during a portion of their life cycle (e.g., striped bass), are known to depend on established complex physical, chemical and biological patterns in the system for many aspects of their reproduction and survival. Due to the concerns of estuarine resource managers and biologists about the effects of severely depressed freshwater inflow and rapidly increasing rates of consumptive losses of water, the Low Freshwater Inflow Study was initated. Because of its importance in influencing the distribution of estuarine organisms, salinity was the major variable used to predict habitat changes for a group of selected Bay organisms. The study was conducted in a series of steps:

- Tests on the Chesapeake Bay Hydraulic Model to determine the salinity change associated with four freshwater inflow conditions;
- Assessment of the effects of increased salinity on the habitat of selected study species;
- Convening of a panel of Bay scientists to judge the significance of the changes in habitat
- Evaluation of effects of increased salinity on Bay resources such as recreation, commercial fishing and water supply;
- Identification of the most promising solutions to the problems caused by reduced freshwater inflow to Chesapeake Bay.

Tests for four different freshwater inflow conditions were conducted on the hydraulic model to determine the effect on salinity of reductions in freshwater inflow:

- Base Average—long-term average inflow conditions
- Future Average—Base Average inflow reduced by projected consumptive losses in 2020
- Base Drought—historical drought inflow conditions for 1963 to 1966
- Future Drought—historical drought of 1963 to 1966, reduced by projected consumptive losses in 2020.

Future inflows were simulated based on projections of water use and consumptive losses for the year 2020. Most of the increase in consumptive losses will result from growth in domestic, industrial, agricultural and electric power generation water useage. The projections show an average reduction to summer Bay inflows of approximately 11 percent by the year 2020. However, consumptive losses would be nearly 60 percent of the natural streamflow if the driest September of record (September 1966) were to recur in 2020.

The assessment of salinity change was done using seasonal average salinities. In general, salinity levels in the Bay range from freshwater at the head of the estuary to near seawater concentrations at the Virginia capes. The Future Average freshwater inflow condition resulted in salinity increases that were between 1 and 3 parts per thousand higher than the Base Average condition. This was considered to be the long-term average (or "permanent") increase in Bay salinity expected by the year 2020.

Future Drought conditions, which, as noted, reflect the combined influences of future consumptive losses

FIGURE 1 Plan View Summer Surface Salinities. "Base Average" Condition

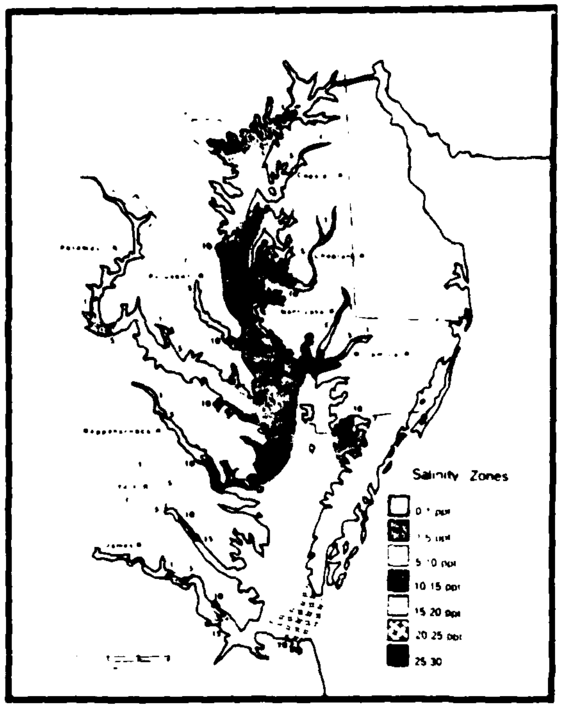
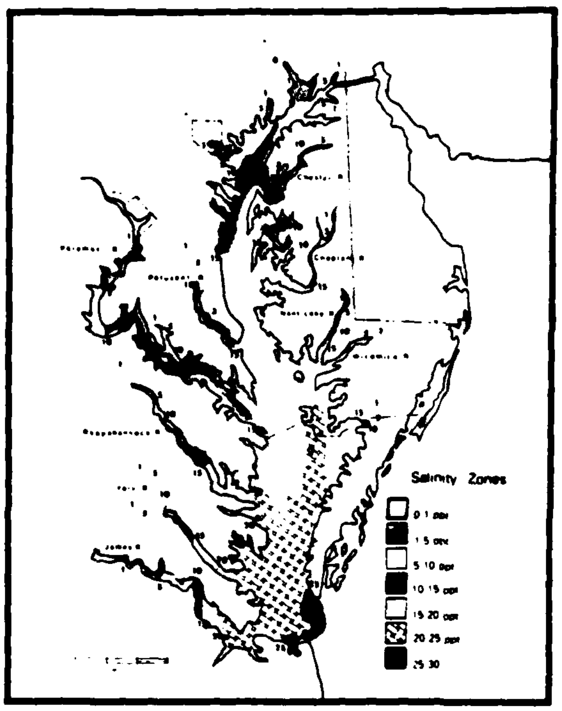


FIGURE 2 Plan View Summer Surface Salinities. "Future Drought" Condition



and drought, cause predicted increases in salinity of between 3 and 8 ppt. The greatest change in salinity occurred in the mid-point of the Bay mainstem and its major tributaries. Changes of lesser magnitude were noted near the freshwater and ocean boundaries.

In addition, the model tests indicate that the Bay would recover from these higher salinities within three to six months following a return to average freshwater inflows. Areas near rivers with higher discharges recover most quickly. The Base Average and Future Drought summer surface salinity distributions are portrayed in Figures 1 and 2.

The potential biological impacts resulting from the predicted salinity changes were identified in a joint effort among the Corps of Engineers, scientific advisors to the study and Western Eco-Systems Technology Inc., Bothell, Washington. Changes in salinity were used to define the habitat and habitat change for 55 representative Bay species. The U.S. Fish and Wildlife Service formed a panel of expert Bay scientists, called the Biota Evaluation Panel (B.E.P.), to interpret how these habitat changes might affect species health and productivity.

The most notable habitat reductions were for the species that live in the middle to upper reaches of the Bay and its tributaries. Compared with the Base Average condition, the most severe habitat losses occurred during Future Drought conditions. This was followed by the Base Drought and Future Average scenarios, in that order.

Oysters were one of the most severely affected Bay organisms. Because of the increases in salinity and subsequent extentions up-Bay of the disease organism MSX, the B.E.P. predicted oysters could be reduced 30 percent under Future Average conditions, and about 80 percent by the Future Drought. Oysters, already affected by the disease in more than 50 percent of their range, were given priority status in this study.

Ecologically, one of the most significant impacts was the reduction in size of the lower salinity zones extending between about 0 and 5 ppt. Many varieties of finfish, including the important Bay species striped bass (rockfish) and shad, use this highly productive area for spawning and as a nursery area for their young. Reductions in this zone are estimated at 20 percent due to Future Average conditions, and nearly 80 percent due to the Future Drought. The very substantial importance of these low salinity areas made their protection a major study priority.

Significant reductions also were predicted for the low salinity varieties of submerged aquatic vegetation (SAV) and the many bottom dwelling animals which lead a more-or-less stationary existence. The abundance of many varieties of rooted SAV is presently very low in the Bay, and the significance of this in the ecosystem is well known. The principal habitat area would be reduced by 10 percent in the Future Average condition and 40 percent in the Future Drought. Impacts of similar significance were identified for the inhabitants of Bay bottoms in the lower and middle salinity areas. Species such as soft clam, and another clam, *Macoma*, would be reduced significantly under both Future Average and Future Drought conditions.

Most of the economic and social impacts identified in the study were direct functions of changes in the Bay's biology. Assessments were conducted for the commerical fishing and recreation industries and for the municipalities and industries that use the Bay as a source of water supply.

The principal components of the Bay commercial fishery are the oyster, blue crab, menhaden, soft clam and striped bass. Together, these species comprise about 96 percent of the $70 million average yearly harvest. Estimates show that these dockside revenues could decline $17 million per year under Future Average conditions. A Future Drought event potentially could result in economic losses over a period of years totaling $325 million. The duration of the effect would include the time needed for recovery of the various important species. Oysters and soft clams accounted for more than 95 percent of these losses. Economic losses due to reductions in striped bass and shad were small. Traditions of oystering and those associated with the Chesapeake Bay waterman were additional study concerns.

Recreational actitivites, such as swimming, boating, waterfowl hunting and sport fishing, also would be affected by decreases in freshwater inflow to the Bay. Changes in the distribution and abundance of species would affect the quality of recreational opportunities and possibly could do economic harm to the Bay's large recreation industry. A summary of the effects on recreation:

- Sea nettles currently detract from swimming and other water-contact pursuits along 85 percent of all Bay beaches. An increase in the density of these organisms during droughts would be the primary effect of reduced freshwater inflow. A low priority was placed on the sea nettle in the planning effort.

- Pleasure boating slips in the Bay could be affected by increased distributions of woodboring clams, commonly known as shipworms. While very significant increase in the number of slips susceptible to shipworm could occur, especially during a Future Drought event, uncertainties concerning the degree of impact made shipworms a low priority species.

- Waterfowl hunters would be indirectly affected by reductions in the foods of favored Bay waterfowl. Canvasback ducks, for example, would decline because of losses of the clam, *Macoma*. Other ducks, such as redhead, pintail and widgeon, would be affected significantly by reductions in SAV. *Macoma* and SAV were priority study species.

- Sportfishing is a major recreational acitivity in Chesapeake Bay. Through its many support facilities and services, sport fishing contributed an estimated $507 million to the economy in 1979. Reduced freshwater inflow could upset the spawning and nursery areas of many species, including the traditional favorites: striped bass and shad. To some extent these losses would probably be replaceable by species of marine origin, such as bluefish and weakfish. If this is the case, economic losses to the region probably would be small. Despite this, it was considered a priority that striped bass and shad be protected for the enjoyment and use of present and future generations of Bay fishermen.

Increases in salinity will also affect the many industries and two municipalities that use the Bay as a source of water supply. Generally, the increased operating costs to the industries would be small. To offset the possibility of health risks, the public systems at Havre de Grace, Md., and Hopewell, Va., have developed contingency plans to protect their water sources from salt intrusion.

Following definition of the problems relating to low flow, a planning effort was undertaken to identify alternative solutions. Measures found to be most promising include those that actually supplement freshwater inflows and those that are oriented to directly managing the depleted Bay resources.

The supplemental flow alternatives include reservoir storage, conservation, restrictions on growth and drought emergency measures. All of these would increase streamflows above those projected for the year 2020. These measures would be either permanently in effect (conservation and growth restrictions) or effective only temporarily during periods of drought (reservoir storage and drought emergency measures). Plans were developed at various levels of detail for all Bay tributaries in which meaningful and identifiable benefits were attainable. A rigorous two phase screening process was conducted for conservation and reservoir storage. A principal screening criteria was the increase in the amount of habitat provided within the defined capability of each measure.

Management measures, such as oyster bed restoration, catch restrictions and finfish restocking, also were investigated. While detailed plans were not developed, these types of plans were nevertheless judged to be potentially feasible and beneficial for important target species such as oysters, striped bass and shad. It was further determined that management measures could be used in conjunction with flow supplementation plans to maximize benefits to the Bay's most valued species and other resources.

In summary, the most promising types of alternative, including both flow supplementation and management measures, include:

- Conservation
- Reservoir Storage
- Growth Restrictions
- Oyster Bed Restoration
- Catch Restrictions
- Finfish Restocking

Based on the above findings, the recommendations of the Low Freshwater Inflow Study are that appropriate agencies or institutions:

1) Further refine the most promising plans for coping with the effects of consumptive water losses and drought in the Chesapeake Bay basin

2) Assure all future actions related to Chesapeake Bay and its resources fully consider the effects of those proposed actions on freshwater inflow to the Bay. Where possible, all actions should incorporate features that minimize the adverse impacts associated with droughts and the increasing consumptive losses of water.

3) Consider conservation in the development of new water supply plans and emphasize new methods to decrease consumptive losses of water.

4) Undertake research and data collection needed to better understand Bay processes and develop appropriate ecosystem models.

5) Undertake studies to determine the effects of the Chesapeake and Delaware Canal on the salinities of Chesapeake Bay.

6) Develop a predictive system to relate the volume and timing of freshwater inflows to Bay salinities. This system would require Bay salinity monitoring and three-dimensional estuarine models.

The Chesapeake Bay Model Tests

The Chesapeake Bay Hydraulic Model, the world's largest estuarine model, was a finely tuned tool designed for comprehensive estuarine study capability. It was used in several important studies of complicated tidal hydraulics problems not yet amenable to solution by mathematical methods.

Following the completion of construction and verifying that model hyradulics and salinity were in acceptable agreement with the prototype, the Corps of Engineers started on the Baltimore Harbor Test. The overall objective of this study was to determine the hydrodynamic changes, if any, in Chesapeake Bay that would result from the proposed enlargement of the navigation channels servicing the port of Baltimore.

The model testing work was done in two phases:

1) A base test to determine benchmark salinity and current velocity conditions in the model with the existing 42—foot deep navigation channel.

2) A plan test, with the proposed 50—foot channel built into the model, was conducted to establish the salinity and velocity conditions that would occur with the project.

Data from the base and plan tests were compared to establish changes resulting from the enlarged channels. The tests revealed little or no change in velocities throughout the Bay or salinity patterns in the Bay below the Potomac River. North of the Potomac River, however, slight salinity changes were recorded in the deep channel areas entering and in the Patapsco River. Surface salinities became slightly fresher and bottom salinities slightly more saline with channel enlargement. Overall, the installation of larger navigation channels would have a very slight impact on Chesapeake Bay.

Work then proceeded on the Potomac River estuary water supply and wastewater dispersion test. This test was designed to explore the ramifications of using the Potomac River estuary as a supplementary source of water supply for Washington, D.C., during periods of drought. The primary concern arising out of using Potomac estuary water is the possibility of recycling wastewater discharged from treatment plants in the area and the intrusion of saltwater into the public water supply. Because of a lack of funding, this test was shortened and not all of the planned freshwater inflow conditions were run on the model. Data collected during the tests indicate that under severe drought conditions the saltwater could penetrate to the upper estuary and the public water supply intake beyond Chain Bridge. Analysis of available model and prototype data suggest, however, that the suitability and treatability of estuary water for public consumption may be more a function of salinity levels during drought than degradation due the discharge of wastewater in the estuary.

The Office of the Chief of Engineers requested that tests simulating oil spills in the Norfolk-Hampton Roads area be done on the Chesapeake Bay Model to determine the probable dispersion of this material in the lower Chesapeake Bay and the James River. Spills varying in volume between 7,000 and 500,000 barrels were simulated by injecting appropriate quantities of crude oil into the model. In turn, the dispersion

of the oil with time was recorded by special cameras as well as by observers. The data collected during this work were forwarded to the Office of the Chief of Engineers to be used in evaluating a permit for a proposed oil refinery in the Elizabeth River.

The Low Freshwater Inflow Problem Identification Test was performed in connection with the Low Freshwater Inflow Study. Its purpose was to determine the changes in salinity caused by decreased freshwater inflows during a reoccurrence of the 1960's drought, as well as under conditions of average freshwater inflow. The data from the tests performed in this series formed the basis from which determinations of the biological and physical effects of low freshwater inflows were identified. The results of the Low Freshwater Inflow Study are discussed elsewhere in this brochure.

The Nanticoke River toxic material dispersion test was done at the request of the State of Maryland. Large quantities of toxic material, stored in containers in an advanced state of deterioration, were found at Sharptown, Md., on the Nanticoke River. State officials were concerned about the occurrence of a spill of this material into the river, and how it would be dispersed over time. The material was later removed to areas of safe storage without incident.

The Norfolk Harbor Channel Deepening Test was performed for the Norfolk District, Corps of Engineers. Its purpose was to determine the changes in the salinity regimes and current patterns caused by deepening the channels into Norfolk Harbor to 55 feet. The data from the test were used to prepare the environmental impact statement for this project.

In addition to these major tests, several other smaller tests were conducted. Included were the Cuyahoga Victim Recovery Test for the Coast Guard, the Patuxent and Chester Rivers Prototype Survey, the Lafayette River Waste Water Dispersion Test for Old Dominion University and the Air Florida Debris Recovery Test, which was done in conjunction with the rescue efforts for the Air Florida airplane accident.

Public Participation — Its Role In The Chesapeake Bay Study

The problems of Chesapeake Bay are of such complexity and magnitude and involve so many varied disciplines that no single entity could be expected to have the requisite personnel, equipment and technical know how to accomplish the many special studies needed to complete this comprehensive investigation. Such expertise does exist, however, among the many agencies which historically have been responsible for certain features of water resources development. The study was therefore conceived as a coordinated partnership among federal, state and local agencies and interested scientific institutions. Each involved agency was asked to provide leadership in those disciplines in which it had special competence. To furnish the necessary avenues for public participation, an Advisory Group, a Steering Committee, and five task groups were established.

Management of the Chesapeake Bay Study was the responsibility of the Baltimore District Engineer. His staff included professionals from the fields of engineering, economics, and the social, physical, and biological sciences. Hydraulic modeling expertise was provided by personnel from the Corps of Engineers' Waterways Experiment Station in Vicksburg, Miss.

The most important public involvement activities during the early stages of the study were the formation of the study organization; the holding of a series of public meetings; and the preparation, review and coordination of the Plan of Study. The public involvement activities, particularly the coordination with the participants, were very important in shaping the overall scope and direction of the study.

During the preparation of the existing and future conditions reports, there were a significant number of important public involvement activities. The study participants met on numerous occasions to shape the scope and content of these reports. The study participants provided valuable advice and support relative to the recommendation for an expanded study in 1978. This phase of the study was also marked with a number of special public involvement events related to the model, including the groundbreaking ceremony in 1973 and the dedication ceremony in 1976. The dedication ceremony marked the start of public tours of the model. The model tours were extremely beneficial in providing the public with an understanding of both the study and the complexities of Chesapeake Bay. The release in April 1973 of a specially prepared film titled "Planning for a Better Bay" which presented a discussion of the Chesapeake Bay and the study and hydraulic model also provided a means to reach large numbers of people with general information about the program. The film was shown on local television and was used over the next several years for literally hundreds of presentations around the study area.

During the preparation of the ***Existing Condition Report***, the Citizens Program for Chesapeake Bay, Inc., (CPCB) was formed and adopted by the Corps as the study's informal Citizen's Advisory Committee. Members of CPCB reviewed and provided comments on both the Existing and Future Conditions reports. Prior to publication of the Future Conditions Report, a series of three public meetings was held around the Bay area to present the preliminary findings of the report and to solicit public comments. In 1978, The first News Circular for the study was also published and distributed to a mailing list of nearly 10,000 interested parties.

As noted above, the public involvement program was a very active one. A wide range of public involvement measures were employed to both disseminate information and solicit advice. Further, the measures used were targeted for a wide spectrum of Bay interests from the general public to Bay scientists and state/local officials.

Public involvement activities during the last stages of the study were similar to those conducted during the first two phases of the program. Advisory Group and Steering Committee meetings were held to seek advice on the conduct and findings of the Tidal Flooding and Low Freshwater Inflow Studies. Two additional news circulars were published to keep the general public advised of study progress and findings. In cooperation with the U.S. Environmental Protection Agency, Maryland and Virginia, two large portable

displays were prepared in January 1979 These displays consisted of a description with appropriate photos and graphics of the Bay related programs of the Corps, EPA and the two states. The displays were circulated throughout the Bay area for exhibit in public buildings, schools, festivals and other appropriate Bay related events In November 1979, the Corps and the Chesapeake Research Consortium, Inc., jointly sponsored an educational seminar to discuss the Bay and the capabilities and potential uses of the model. The seminar was held at the newly opened visitor center at the hydraulic model and was attended by engineers, scientists and academicians from the Bay area.

Perhaps the most significant public involvement activity of the study was the model tour program Although this program began in May 1976 following the dedication of the model, it was greatly enhanced in August 1979 with the completion of the visitor center. The visitor center facility and tour provided a complete Chesapeake Bay and Hydraulic Model experience The lobby of the visitor center had numerous displays which explained the Bay and the hydraulic model The visitor then could enter the auditorium for a 20-minute narrated slide show which further described the Bay and its problems and the Corps' study and hydraulic model. Lastly, the visitor received a 30-minute guided tour of the model with an even more detailed discussion of how the model operated and a description of the testing being conducted at that time. Generally, the tours were provided three times a day and five days a week for the entire period between May 1976 and May 1983. The model also was open on selected weekends for such events as Chesapeake Appreciation Days. During the seven year period the model was open, approximately 120,000 people from every state and numerous foreign countries visited the model and received some appreciation and understanding of both the Bay and the Corps' program.

The public involvement program was judged to be quite extensive during the final study phase. The model tours and related events were probably the most visible activities; however, the coordination and review work with the study participants and other interested parties was most important in developing the final recommendations of the study.

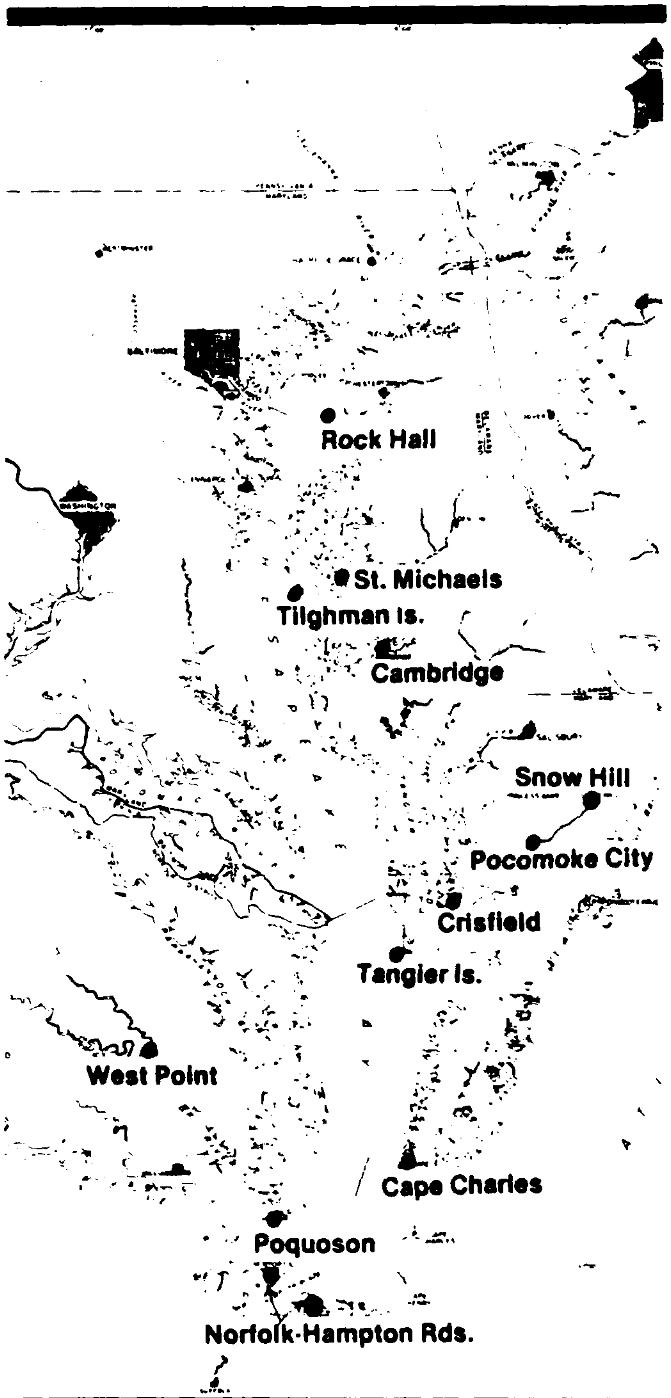
Tidal Flooding Study

Tidal flooding of low lying areas adjacent to the Chesapeake Bay shoreline is an occasional natural phenomenon Over the years, tidal flooding has caused significant human suffering and millions of dollars damage. Because of the magnitude and Bay-wide nature of the problem it was chosen as one of the two priority studies in the final phase of the Chesapeake Bay Study

The Tidal Flooding Study had three primary objectives (1) to provide a better understanding of the tidal flood stage-frequency relationship; (2) to define the environmental and socio-economic impacts of tidal flooding; and (3) to recommend structural or non-structural measures for tidal flood protection in those communities where it was found to be economically and environmentally feasible and socially acceptable

Serious tidal flooding in the Chesapeake Bay region is caused by either hurricanes

FIGURE 3 Floodprone Communities Selected For Detailed Study



or "northeasters." The hurricanes of August 1933, October 1954 (Hazel) and August 1955 (Connie) and the "northeasters" of March 1962 are all examples of storms which caused millions of dollars of tidal flood damage.

The initial step in the study was to identify those communities or urban areas that were subject to tidal flooding. During this initial screening, approximately 60 communities or urban areas having a population of 1000 or greater were found they had potential tidal flood problems. Subsequent analyses of those 60 communities revealed that only 12 areas had serious enough tidal flood problems to warrant detailed analyses. Those communities selected for detailed study are listed on Table 1 and their locations are shown on Figure 3.

Table 1

Communities With Potentially Serious Tidal Flooding

Maryland	Virginia
Cambridge	Cape Charles
Crisfield	Hampton Roads*
Pocomoke City	Poquoson
Rock Hall	West Point
Snow Hill	Tangier Island
St. Michaels	
Tilghman Island	

*Includes the cities of Chesapeake, Hampton, Norfolk and Portsmouth

The next step in the study was to conduct flood damage surveys in each of the 12 selected communities. These surveys identified those sections of each community that were most susceptible to tidal flooding. They also established the relationship between tidal flood stages and expected damages. Given the character and extent of the flood problem, consideration then was given to the various structural and non-structural measures that could be used to prevent tidal flood damages.

Generally speaking, the types of structural measures considered were levees or flood walls. Both are constructed near the shoreline to protect landside development from inundation by tidal flood waters. Non-structural solutions included regulatory actions by communities to avoid land use patterns which conflicted with tidal flooding or individual measures by property owners to prevent tidal flood damage. Some non-structural measures considered were flood proofing, relocation of structures, flood forecasting, evacuation, acquistion, demolition and a public awareness program.

Both structural and non-structural measures were found to reduce or prevent the adverse effects of tidal flooding. Structural measures, while effective, were expensive and usually produced adverse environmental impacts. In addition, residents often were opposed to structural solutions on aesthetic grounds and because direct access to the Bay's shoreline was hindered. Non-structural solutions usually were less expensive and less environmentally damaging than structural projects. Voluntary participation by nearly all residents and businesses is required, however, to make a community-wide non-structural program effective. In most communities, combinations of structural and non-structural measures were found to be the best plans for tidal flood protection.

The federal government can participate in a flood control project only if the average annual value of the damage prevented by it exceeds the annual cost of construction, operation and maintenance. In other words, the benefit to cost ratio must be one or greater. None of the communities in Maryland met this criterion. In Virginia, however, the benefit to cost ratios of some of the possible solutions for Poquoson, Tangier Island and the Hampton Roads area were sufficiently high to warrant future, more detailed studies.

While in most cases federal action could not be justified, certain steps can be taken by the locals to reduce the effects of tidal floods. One of the most promising is the development of an accurate tidal flood forecasting and warning system. Included in the system would be such items as advanced tidal surge forecasts, communications networks to inform residents of potential flooding, permanent markers in critical areas to indicate flood heights, planned evacuation routes and designation of shelters. Another step is to encourage land use patterns in floodprone areas which are compatible with periodic tidal flooding. These land use patterns should be established at the local level through comprehensive planning documents, zoning ordinances or land use regulations. Key to all of the above actions is the need for more accurate forecasts of tidal flood stages. Further investigations of tidal flooding should include development of the storm surge model needed to make these forecasts.

In light of the findings discussed above, the recommendation of the Tidal Flooding Study is that the Corps of Engineers conduct detailed tidal flooding studies in the Poquoson, Tangier Island and Hampton Roads areas of Virginia. Further, any additional tidal flooding studies should include the development and verification of a mathematical storm surge model capable of forecasting tidal flood stages and developing stage-frequencies.

Other Findings

The Existing and Future Conditions reports include descriptions of the physical, economic, social and biological conditions of the Bay, and projections of resource requirements for the year 2020. Together, the reports document the importance of the Bay and its many resources within an area extending approximately to the head of tide around the Bay (i.e., the "Bay Region"). In addition to the waterborne transportation network on which much of the economic development of the region has been based, the reports show that the Bay and its tributaries offer a wide variety of recreation opportunities, a productive environment for production of fish and wildlife, a source of water supply for both city and industry and a site for disposal of a wide variety of waste products.

A projected doubling of the area population is an indicator of the added pressure that will be exerted on the Bay and its limited resources by the year 2020. Notable increases are expected in the development of land, water supply, waterborne commerce, electrical power and recreation.

Recent computations by the U.S. Department of Commerce indicate the emergence of a somewhat slower growth rate than predicted in the ***Future Conditions Report.*** Despite this, future demands for use of the Bay and its resources will inevitably occur. A continued awareness and concern for emerging conflicts is warranted.

The report on Tropical Storm Agnes documented the effects of the storm which, in June 1972, unleashed the full force of her destructive power on the Bay's drainage basin. Due to the effects of Agnes, many

communities in the river basins tributary to Chesapeake Bay were completely isolated and thousands of people were left homeless.

Ecological effects of the storm also were large. The Bay life most affected by the massive freshwater inflows were species such as soft clam and oyster. These immobile species were intolerant to the extended period of reduced salinity that occurred in the Bay following the storm. Other effects in the Bay because of Agnes resulted from the large influxes of nutrients, sediment, toxic materials and debris.

Thus, in addition to the recommendations presented earlier for low freshwater inflow and tidal flooding, other recommendations result from the findings of the Existing and Future Conditions reports, and the Agnes report. These are:

1) Authorize the Corps of Engineers to initiate studies of the more immediate Bay resource problems identified in the Future Conditions Report. These include:

a) Develop water supply and drought management strategies that will optimize use of existing water supplies in the Bay drainage basin and minimize reductions in freshwater inflow to the Bay.

b) Develop plans from a Bay-wide perspective for dredged material disposal that will allow for future channel maintenance and improvements at Baltimore and Norfolk harbors and the approaches to the C & D Canal and other locations in Chesapeake Bay.

2) The appropriate agencies and institutions endeavor to:

a) Update the Future Conditions Report to serve as a water resource data base and to renew perspective on existing and potential future problems and conflicts in the Bay Area.

b) Establish a central data repository and retrieval system for all Chesapeake Bay related information.

c) Initiate studies of the effects of high freshwater inflow on Chesapeake Bay.

US Army Corps of Engineers
Baltimore District

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, BALTIMORE
CORPS OF ENGINEERS

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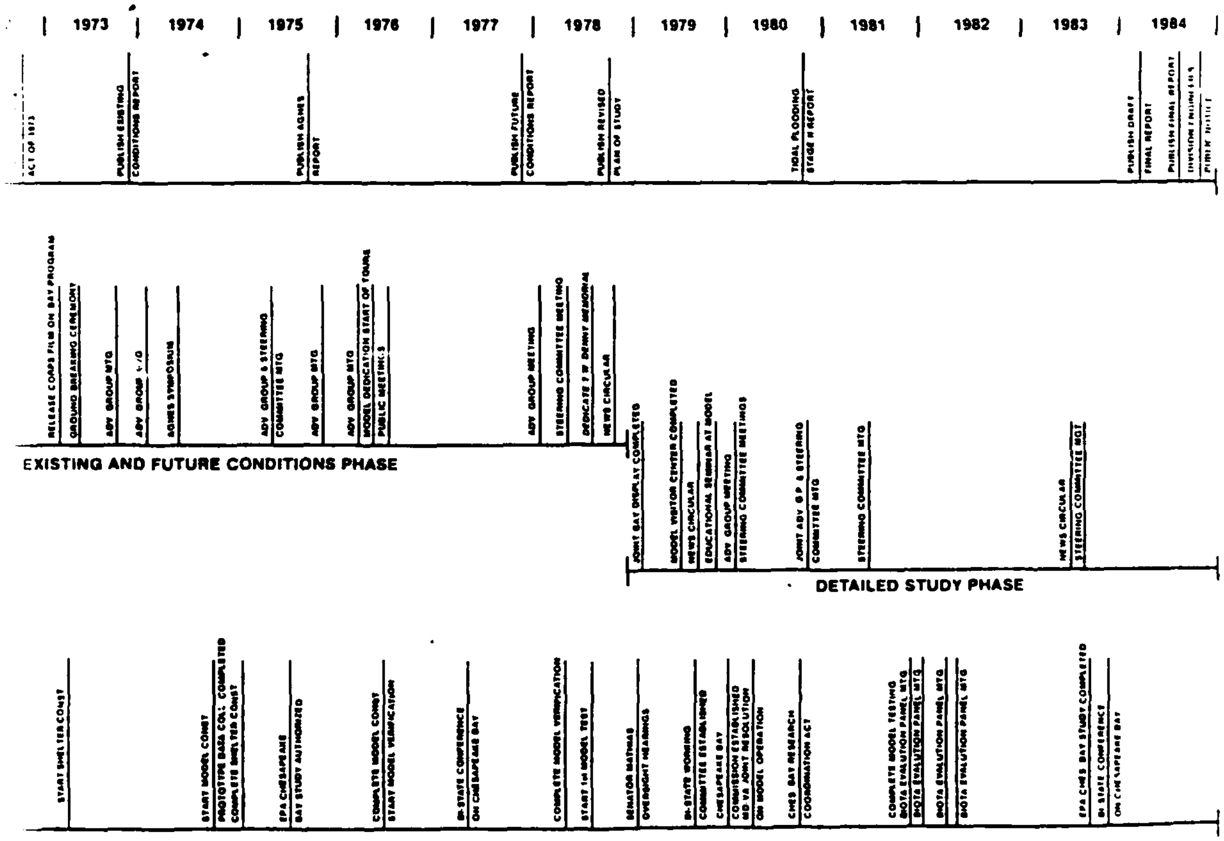
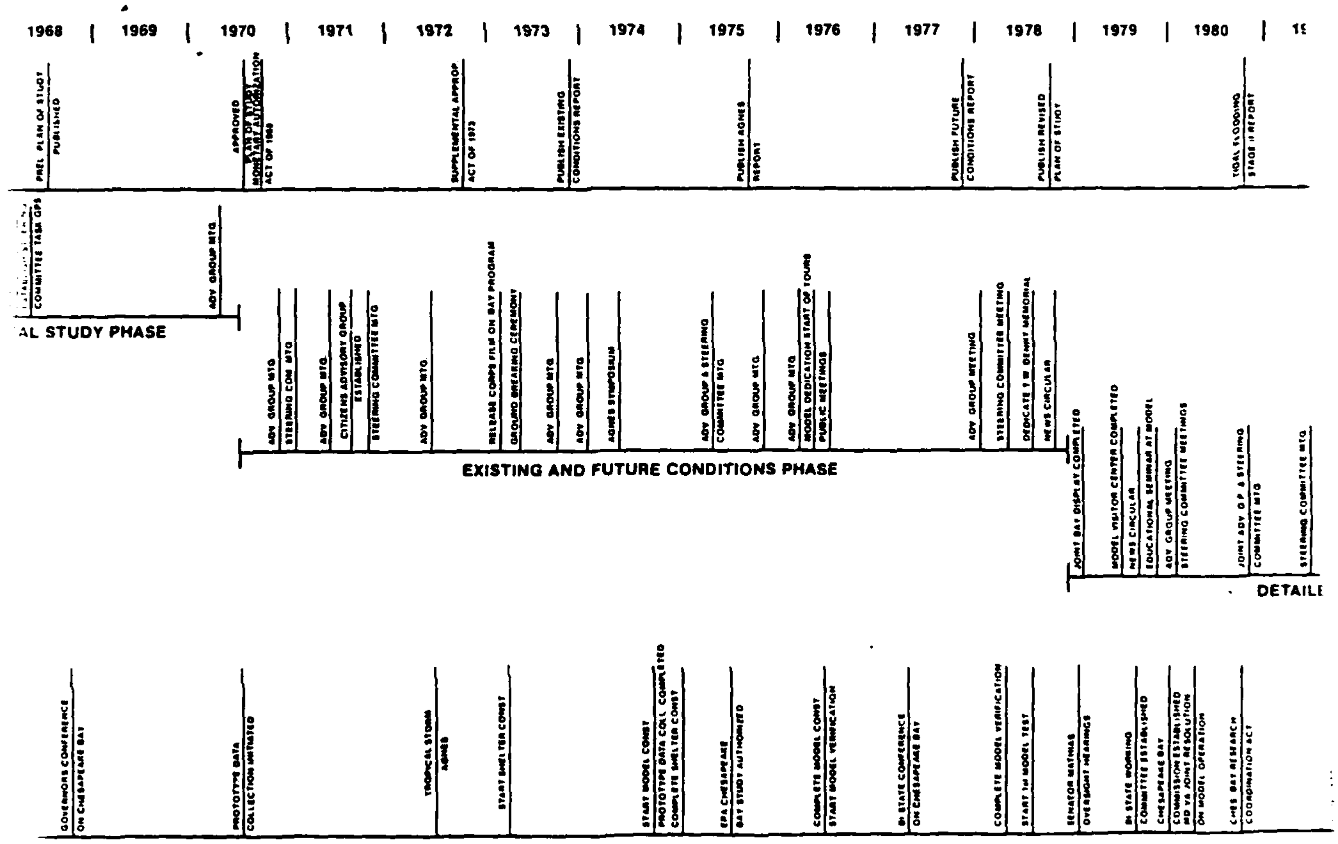
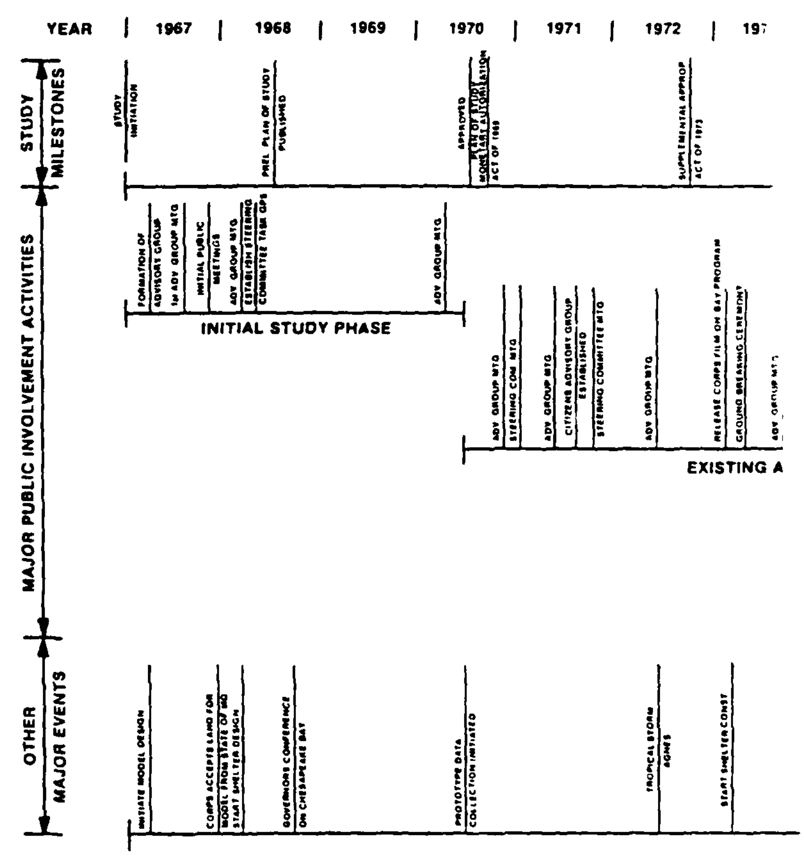
CHESAPEAKE BAY STUDY
SEQUENCE OF SIGNIFICANT EVENTS



CHESAPEAKE BAY STUDY
SEQUENCE OF SIGNIFICANT EVENTS





YEAR
1967
1968
1969
1970
1971
1972
197
STUDY MILESTONES
STUDY INITIATION
PREL. PLAN OF STUDY PUBLISHED
SUPPLEMENTAL APPROP ACT OF 1972
MAJOR PUBLIC INVOLVEMENT ACTIVITIES
FORMATION OF ADVISORY GROUP
1st ADV GROUP MTG
INITIAL PUBLIC MEETINGS
ADV GROUP MTG
ESTABLISH STEERING COMMITTEE TASK GPS
ADV GROUP MTG
INITIAL STUDY PHASE
ADV GROUP MTG
STEERING COM MTG
ADV GROUP MTG
CITIZENS ADVISORY GROUP ESTABLISHED
STEERING COMMITTEE MTG
ADV GROUP MTG
RELEASE CORPS FILM ON BAY PROGRAM
GROUND BREAKING CEREMONY
EXISTING A
OTHER MAJOR EVENTS
INITIATE MODEL DESIGN
CORPS ACCEPTS LAND FOR MODEL FROM STATE OF MD
START SHELTER DESIGN
GOVERNORS CONFERENCE ON CHESAPEAKE BAY
PROTOTYPE DATA COLLECTION INITIATED
TROPICAL STORM AGNES
START SHELTER CONST

CHESAPEAKE BAY STUDY
SUMMARY REPORT

SUPPLEMENT C
THE CHESAPEAKE BAY HYDRAULIC MODEL

Department of the Army
Baltimore District, Corps of Engineers
Baltimore, Maryland
September 1984

CHESAPEAKE BAY STUDY
SUMMARY REPORT
SUPPLEMENT C - THE CHESAPEAKE BAY HYDRAULIC MODEL

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SUPPLEMENT C
THE CHESAPEAKE BAY HYDRAULIC MODEL

INTRODUCTION

The hydraulic model is one of the most versatile instruments available to the hydraulic engineer, water resources planner and scientist. In the Chesapeake Bay Study, the hydraulic model provided a means of reproducing to a manageable scale many natural events and man-made changes and thereby allowing the collection of the data necessary to assess the consequences of various happenings. As an instrument and physical display, the hydraulic model was unexcelled in its potential for the education of an interested public in the scope and magnitude of the problems and conflicts of use that can beset this water resource. As an operational focal point, the model promoted more effective liaison among the agencies working in the Bay waters, helping to reduce duplication of effort and leading to the accelerated spreading of knowledge among the interested parties.

AUTHORITY

The authority for the Chesapeake Bay Study and the construction of the hydraulic model is contained in Section 312 of the River and Harbor Act of 1965, adopted 27 October 1965, which reads as follows:

> (a) The Secretary of the Army, acting through the Chief of Engineers, is authorized and directed to make a complete investigation and study of water utilization and control of the Chesapeake Bay Basin, including the waters of the Baltimore Harbor and including, but not limited to, the following: navigation, fisheries, flood control, control of noxious weeds, water pollution, water quality control, beach erosion, and recreation. In order to carry out the purposes of this section, the Secretary, acting through the Chief of Engineers, shall construct, operate, and maintain in the State of Maryland a hydraulic model of the Chesapeake Bay Basin and associated technical center. Such model and center may be utilized, subject to such terms and conditions as the Secretary deems necessary, by any department, agency, or instrumentality of the Federal Government or of the States of Maryland, Virginia, and Pennsylvania, in connection with any research, investigation, or study being carried on by them of any aspects of the Chesapeake Bay Basin. The study authorized by this section shall be given priority.
>
> (b) There is authorized to be appropriated not to exceed $6,000,000 to carry out this section.

An additional appropriation for the study was provided in Section 3 of the River Basin Monetary Authorization Act of 1970, adopted 19 June 1970, which reads as follows:

> In addition to the previous authorization, the completion of the Chesapeake Bay Basin Comprehensive Study, Maryland, Virginia, and Pennsylvania, authorized by the River and Harbor Act of 1965 is hereby authorized at an estimated cost of $9,000,000.

As result of Tropical Storm Agnes, which caused extensive damage in Chesapeake Bay, Public Law 92-607, the Supplemental Appropriation Act of 1973, signed by the President on 31 October 1972, included $275,000 for additional studies of the impact of the storm on Chesapeake Bay.

STUDY PURPOSE AND OBJECTIVES

Historically, measures taken to utilize and control the water and land resources of the Chesapeake Bay Basin have generally been oriented toward solving individual problems. The Chesapeake Bay Study provided a comprehensive study of the entire Bay area in order that the most beneficial use be made of the water-related resources. The major objectives of the study were to:

a. Assess the existing physical, chemical, biological, economic, and environmental conditions of Chesapeake Bay and its water resources.

b. Project the future water resources needs of Chesapeake Bay to the year 2020.

c. Formulate and recommend solutions to priority problems using the Chesapeake Bay Hydraulic Model.

The Chesapeake Bay Existing Conditions Report, published in 1973, met the first objective of the study by presenting a detailed inventory of the Chesapeake Bay and its water resources. Divided into a summary and four appendices, the report presented an overview of the Bay area and the economy; a survey of the Bay's land resources and its use; and a description of the Bay's life forms and hydrodynamics.

The Future Conditions Report published in 1976 provided a format for presenting the findings of the second phase of the Chesapeake Bay Study. Satisfying the second objective of the study, the report described the present use of the resource, presented the demands to be placed on the resource to the year 2020, assessed the ability of the resource to meet future demands, and identified general means to satisfy the projected resource needs. A summary of the findings of both the Existing Conditions Report and the Future Conditions Report may be found in Supplement A of this final report.

It remains for this final report of the Chesapeake Bay Study to provide an overview of the entire study and to present the findings of the studies of the priority problems.

RELATIONSHIP BETWEEN STUDY AND HYDRAULIC MODEL

Simply stated, the Chesapeake Bay Hydraulic Model was a scientific tool used by the water resources planners to analyze the hydrodynamics of the Chesapeake Bay and tributaries. The model was used to analyze problems that could not be resolved from text books, experience or mathematical treatment alone. The model provided an accurate reproduction of the Bay's physical processes and permitted the simulation of both natural and man-made events. The data from these simulations were necessary to understand the physical and, in turn, environmental consequences of the reoccurence of natural events and man-induced changes. Only through a melding of analytical studies and hydraulic model testing could the water resources planner develop a comprehensive plan that addresses some of the Bay's more serious problems.

PURPOSE OF SUPPLEMENT

The purpose of this supplement is to provide a description of the Chesapeake Bay Hydraulic Model and the testing that was conducted on the model. The description of the model includes the model's capabilities, the prototype data collection program, model construction and verification and, lastly, the ultimate disposition of the model. The discussion of the model testing program is limited to an overview of each test to include the purpose of the test, the type(s) of data collected and a reference to the appropriate testing report.

THE CHESAPEAKE BAY HYDRAULIC MODEL

LOCATION

The hydraulic model of Chesapeake Bay was located at Matapeake, Maryland, on a 60 acre tract of land donated by the State of Maryland. The site was on the Delmarva Peninsula, along Maryland Route 8 and approximately 3 miles south of the eastern terminus of the William Preston Lane Memorial Bridge (Chesapeake Bay Bridge). It was within commuting distance of over 3,000,000 people being less than 50 miles from both Washington, D.C. and Baltimore, Maryland.

DESCRIPTION

MODEL LIMITS AND SCALE

The physical model of Chesapeake Bay, constructed at Matapeake, Maryland, during the period October 1974–April 1976, was a fixed-bed model molded in concrete to conform to the bathymetry of the most recent National Ocean Survey (NOS) charts at the time of construction (Coast and Geodetic Survey prior to 1970). The model covered approximately 8.6 acres and was completed housed in a 14-acre building for protection from the elements (Figure C-1). The building was approximately 1000 ft long and 600 ft wide. The molded area of the model as shown in Figure C-2 extended from offshore in the Atlantic Ocean to the head of tide for all tributaries emptying into Chesapeake Bay. The entire length of the Chesapeake and Delaware (C&D) Canal extending to Delaware Bay was also modeled. Model reproduction extended to the +20 foot contour as shown on US Geological Survey (USGS) quadrangle maps.

The hydraulic model was based on the equality of model and prototype Froude numbers reflecting similitude of gravitational effects as opposed to viscous effects (Reynolds number model). Geometric scales of the model were 1:1000 horizontally and 1:100 vertically, reflecting a scale distortion of 10:1. For distorted-scale models, the characteristic length is that of the vertical dimension. Therefore, the Froude number is defined as:

$$F_n = \frac{V}{gD}$$

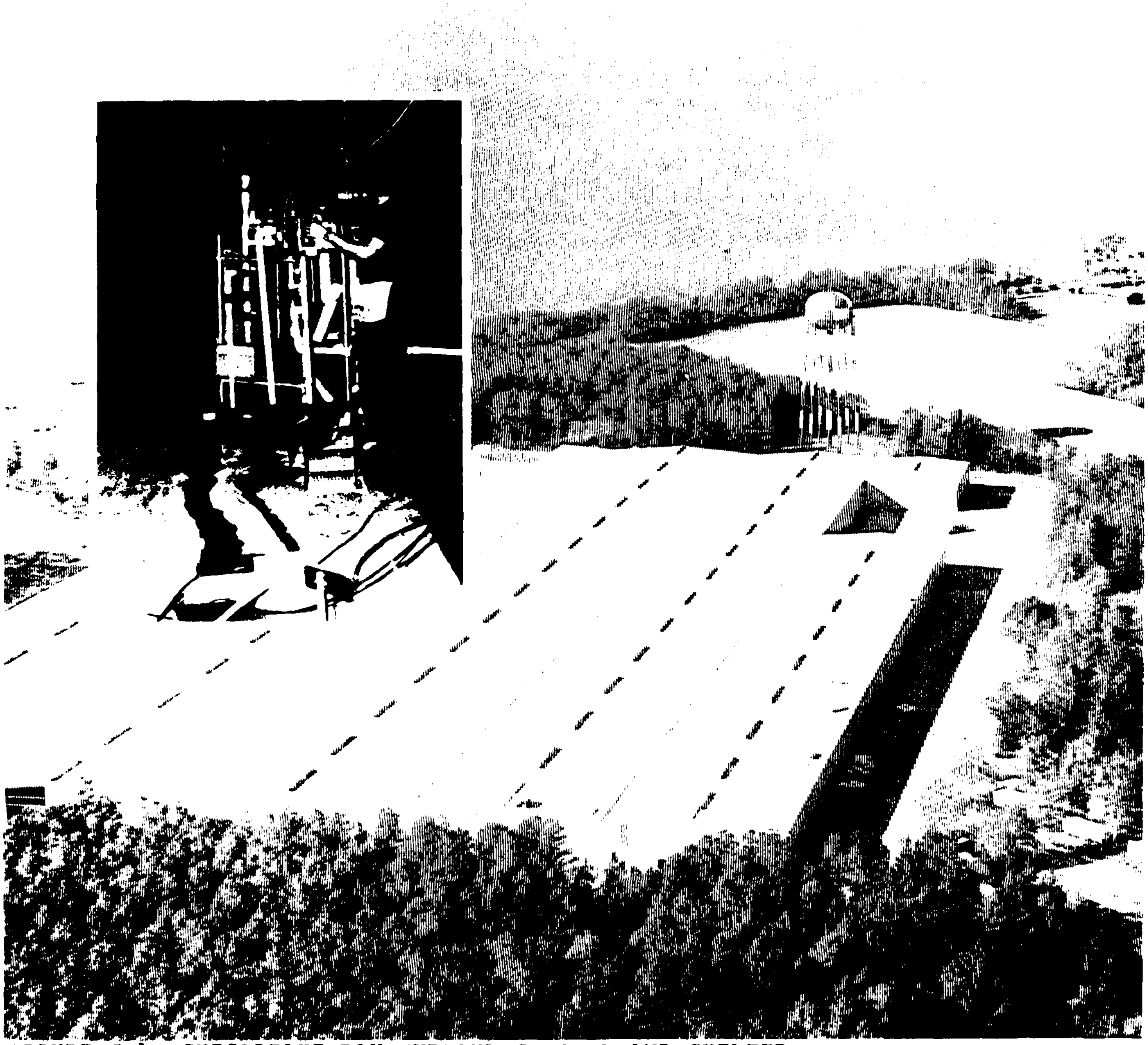


FIGURE C-1 CHESAPEAKE BAY HYDRAULIC MODEL AND SHELTER

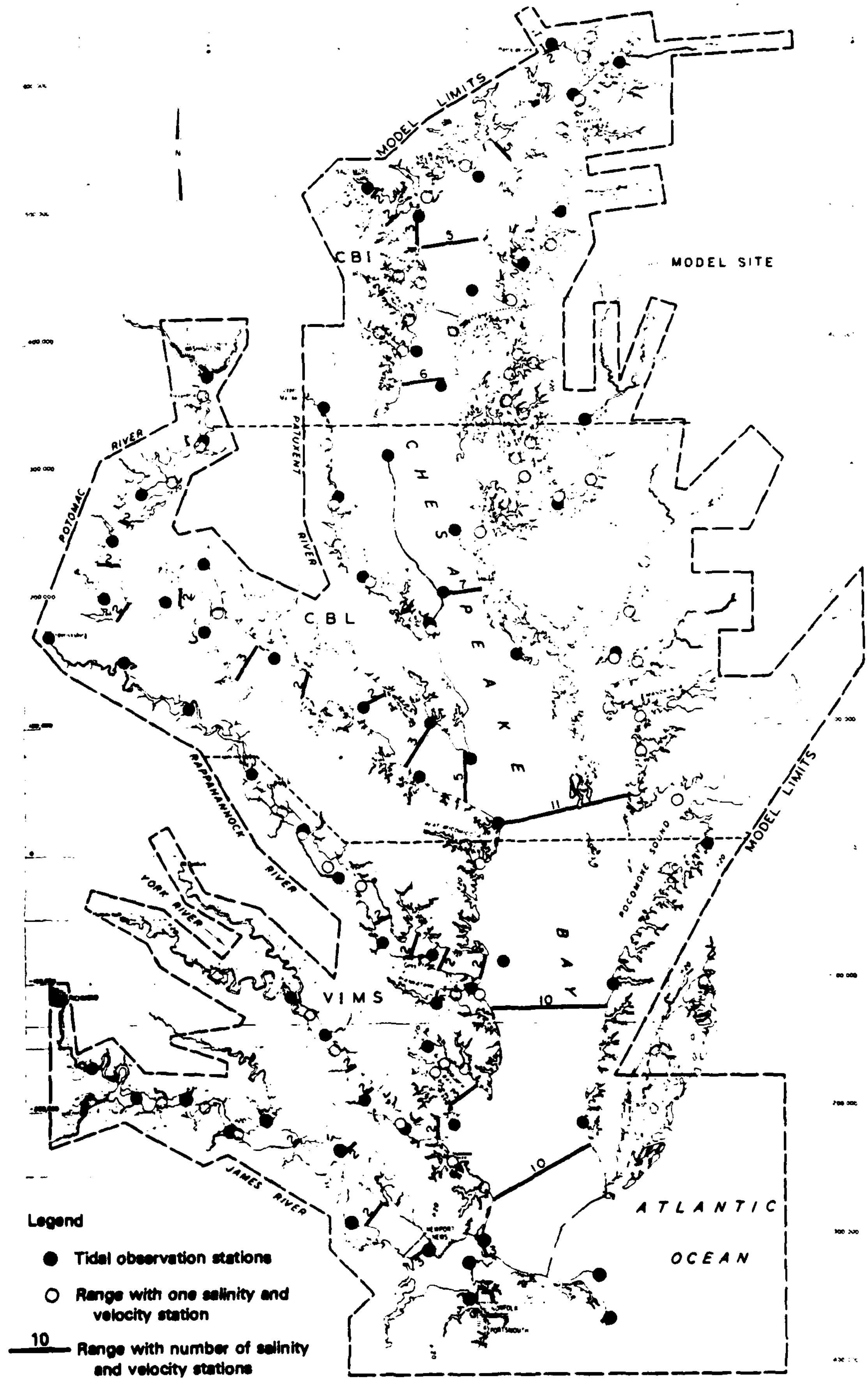


FIGURE C-2 MODEL LIMITS AND FIELD DATA STATIONS

The following scales are determined by use of geometric relations and Froudian model laws:

Characteristic	Ratio
Vertical length	$D_r = 1:100$
Horizontal length	$L_r = 1:1000$
Time	$T_r = L_r/\sqrt{D_r} = 1:100$
Velocity	$V_R = \sqrt{D_R} = 1:10$
Discharge	$Q_r = V_r A_r = L_r \sqrt{D^3}_r = 1:1,000,000$
Volume	$L^2_r D_r = 1:100,000,000$
Slope	$D_r/L_r = 10:1$

As in most estuary models, the salinity density ratio was unity. Additional bottom roughness is required in distorted-scale models to ensure that the flow regime remains turbulent so that the proper reproduction of tidal heights, tidal velocities, and salinity distributions can be achieved. In relatively deep areas (greater than about 10 ft), additional roughness was simulated in the model by embedding stainless steel strips in the model floor. The preliminary distribution of these strips was calculated as a function of depth using conservation of linear momentum considerations. Based on these calculations, over 700,000-1/2 inch-wide roughness strips were placed in the model. Final distribution was then obtained by trial and error by systematically bending up or bending down these strips until proper amplitude and phasing of tidal heights and velocities were obtained. In shallow-water areas, the additional roughness was achieved by scratching the concrete surface during model construction.

MODEL APPURTENANCES

The model was designed to include all necessary appurtenances for the reproduction of prototype boundary conditions and the measurement of the model response to those boundary conditions. An additional capability of the model complex was the ability to operate as a completely self-contained unit. The appurtenances necessary to achieve these goals include both manual and computerized model control and data-gathering capabilities in addition to a complete water supply treatment, storage and distribution system. Backup emergency power generation and uninterruptible power system capabilities were provided so that continuous operation of the model could be ensured. Laboratory facilities were provided for in-house analysis of salinity and dye dispersion studies. The primary appurtenances of the model are described below.

COMPUTER FACILITIES

The computer facilities were comprised of several minicomputers and related software that were used for both model control and data analysis. One minicomputer was devoted to model control (freshwater inflow and primary and secondary tide generation) and data acquisition to include water-level detectors, tide generators and inflow monitoring. An uninterruptible power supply system was included to ensure continuous computer control during power fluctuations and outages.

Model control and data acquisition by the minicomputer were made possible by a multiple-loop, multiple-rank, two-way data transmission system. The system used a

current-loop technique in which serial ASCII (Amercian Standard Code for Information Interchange) data were transmitted between the minicomputer and the various model devices over a twisted pair cable. The method of transmission was designed to minimize signal distortion and time skewing of data due to the long cable lengths associated with the model. This serial data exchange system (SERDEX) was managed by a hierarchical software package developed specifically for the Chesapeake Bay Model configuration.

The above-described system enabled complete programmable computer control of the tide generators and freshwater inflow devices and provided monitoring capabilities for all automated devices on the model. Monitored data could be transmitted to a data terminal for immediate review (visual) to ensure proper model control and response and/or stored on flexible disks for later data reduction and management.

FRESHWATER INFLOW CONTROL SYSTEM

Programmable freshwater inflow control devices capable of reproducing variable hydrographs were located at 21 strategically selected inflow points on the model. Each inflow control unit consisted of a pressure regulator, a digital flow control valve, and a flowmeter. A mechanical spring-type pressure regulator ensured constant pressure to the digital flow control valve. Each digital valve contained eight solenoid valve actuators associated with a binary addressable progression of orifice openings. A total of 256 discrete flow rates could be obtained for each valve by energizing different combinations of solenoid valves. In general, two size ranges of digital valves were used to produce a flow range of 0.01 to 155 gpm. Two types of flowmeters were used to measure this range of discharge - a small bearingless type meter and a venturi-type fluidic metering device.

WATER SUPPLY SYSTEM

All water utilized in the model was supplied by two deep wells with discharge capabilities of 250 and 500 gpm. Water storage was provided by a 500,000-gal elevated storage tank. The water treatment plant could supply an average flow of 400 gpm indefinitely, or a flow of 1250 gpm for an 8-hr period of operation. The primary trunk lines could carry a total discharge equivalent to double the maximum flow of record for the Susquehanna River, plus the maximum flows of record for all other tributaries. This flow totaled approximately 1661 gpm. Minimum pressure was 50 psig.

TIDE GENERATORS

Tides in the model were reproduced by a primary tide generator in the model ocean and a secondary tide generator at the eastern end of the C&D Canal. Both generators were capable of either computer control or manual control. Under computer control, serial ASCII tide elevation data were transmitted from the computer to the tide control receivers. These data were then converted to parallel BCD and further converted through a D-A converter to a voltage. This voltage changed the position of the shaft of a pneumatic pressure-sensing bubble-tube positioner (which indicated the actual model water level) by use of a servomotor. The change in shaft position changed the back pressure on the bubble-tube positioner, thus indicating an error between the actual and desired model water levels. These pressure changes were used by the pilot regulator to adjust the rolling gates on the inflow-outflow system (which controlled the water-level elevation of the headbay area), thereby generating the tide. This system provided the capability of simulating any desired tide sequence including, but not limited to, a lunar month of variable tides producing both neap and spring variations. The length of the

desired control tide signal was limited only by the storage capacity of the computer. Under manual control, a repetitive 24.84-hr tidal cycle was produced by the rotation of a cam constructed to represent the elevation changes for a predetermined tidal cycle. Movement of the cam activated a potentiometer that produced the voltages used to change the position of the shaft of the bubble-tube positioner. A repetitive tide was therefore produced in a fashion similar to the computer-controlled tide.

In more physical detail, the primary tide generator consisted of a gravity inflow-gravity outflow system containing a return sump (160 by 60 by 11 ft) at a minus elevation (relative to the model ocean), a supply sump (72 by 60 by 15 ft) at a positive elevation fed by a 20-cfs pump from the return sump, and a headbay area (211 by 20 by 8 ft) varying about a mean level. Two rolling gates, connecting the headbay area with both the supply and return sumps, operated simultaneously to achieve the desired headbay elevation, thereby generating the desired ocean tide. A continuous circulation between the three areas helped maintain a desired source salinity. The operation of the primary tide generator and a schematic drawing of its operation are shown in Figure C-3. The secondary tide generator was much smaller but operated on the same general principle.

SALTWATER SUPPLY SYSTEM

Constant ocean salinity was assured by maintaining a prescribed concentration of the source salinity in the supply sump. Saturated brine (315-320 ppt) was obtained by mixing granular salt (NaCl) and water in a 35- by 30- by 15-ft storage sump. The brine was mixed with the model solution in the return sump to obtain a desired salinity. This well-mixed solution was then pumped to the supply sump for input to the model.

SKIMMING WIERS

A low salinity (brackish) accumulation in the surface layer of the model ocean will develop due to the constant addition of fresh water at the inflow locations. In order to maintain the model ocean at a constant salinity and at the proper water-level elevation, this brackish water lens must be removed. This operation was performed by the use of skimming weirs which were adjusted to draw off a discharge equal to the total fresh-water inflow to the model. The operation of the skimming weirs and a schematic drawing are shown in Figure C-4.

MIXING WEIRS

The mixing weir system consisted of five vertical 6-in.-diameter risers submerged just below the ocean surface. These weirs, located bayward of the headbay, ensured proper mixing of the ocean water. Water drawn off by the mixing weir was gravity-fed back to the return sump, remixed with the salt water, and returned to the model ocean via the supply sump. Without the mixing weir, brackish water that was not drawn off by the skimming weirs would have diluted the ocean and hindered the maintenance of the correct ocean salinity.

INDUCED MIXING BUBBLER SYSTEM

A bubbler system was installed in the model to provide additional vertical mixing. The system consisted of a compressor supplying air through perforated tygon tubing placed along the axis of the bay and major tributaries. Single lines extended up the tributaries with perforations at approximately 12-ft. intervals. The main Bay configuration approximated a 12-ft. perforation grid.

OPERATION OF TIDE GENERATOR

THE WATER SURFACE OF THE MODEL (A) IS APPROXIMATELY 5 FT HIGHER THAN RETURN SUMP (B) AND 10 FT LOWER THAN SUPPLY SUMP (C). BECAUSE OF THESE DIFFERENCES IN WATER-SURFACE ELEVATIONS, THE FLOW OF WATER FROM THE MODEL INTO THE RETURN SUMP AND OUT OF THE SUPPLY SUMP INTO THE MODEL IS GRAVITY FLOW. THE TWO ROLLING GATES (D&E) OPERATE IN TANDEM SUCH THAT WHEN ONE GATE IS OPENING, THE OTHER GATE IS CLOSING. WHEN THE SUPPLY SUMP ROLLING GATE (D) IS OPENING AND THE RETURN SUMP ROLLING GATE (E) IS CLOSING, A NET POSITIVE FLOW RESULTS, AND THE MODEL FLOODS. WHEN THE SUPPLY SUMP ROLLING GATE IS CLOSING, AND THE RETURN SUMP ROLLING GATE IS OPENING, A NET NEGATIVE FLOW RESULTS AND THE MODEL EBBS. A PUMP (F) BETWEEN THE SUMPS MAINTAINS A CONSTANT AMOUNT OF WATER IN THE SUPPLY SUMP. SIGNALS FROM THE TIDE SENSOR (H) AND TIDE PROGRAMMER (I) OR COMPUTER (NOT SHOWN) ARE COMPARED BY THE TIDE CONTROL (G) WHICH THEN DETERMINES THE PROPER OPENING OF THE ROLLING GATES TO REPRODUCE THE DESIRED TIDE.

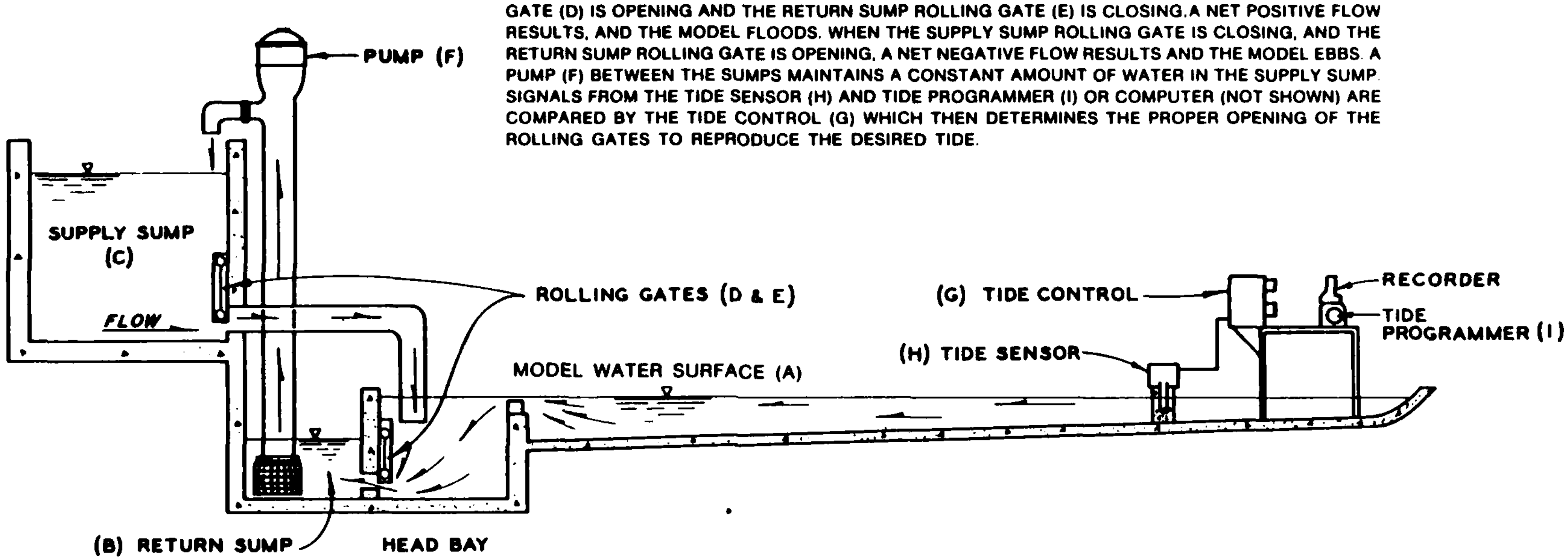


FIGURE C-3 PRIMARY TIDE GENERATOR

SKIMMING WEIR OPERATION

THE FRESH WATER FROM THE TRIBUTARIES THAT ACCUMULATES IN THE MODEL OCEAN HAS TO BE REMOVED IN ORDER TO MAINTAIN A CONSTANT OCEAN SALINITY AND PROPER TIDAL ELEVATIONS. BECAUSE BRACKISH WATER IS LESS DENSE THAN THE OCEAN SALT WATER, A BRACKISH WATER LENS FORMS ON THE SURFACE OF THE MODEL OCEAN. REMOVAL OF THIS BRACKISH WATER IS ACCOMPLISHED BY THE USE OF SKIMMING WEIRS PLACED IN THE MODEL OCEAN. THESE WEIRS FLOAT SLIGHTLY BELOW THE WATER SURFACE AND ALTHOUGH THEY RISE AND FALL WITH THE TIDE, THEY MAINTAIN A CONSTANT DEPTH BELOW THE SURFACE THE SKIMMING WEIRS ARE SUBMERGED TO A DEPTH SUCH THAT THEY "SKIM" OR DRAW OFF A DISCHARGE EQUAL TO THE AVERAGE FRESH WATER DISCHARGED INTO THE MODEL FROM THE TRIBUTARIES.

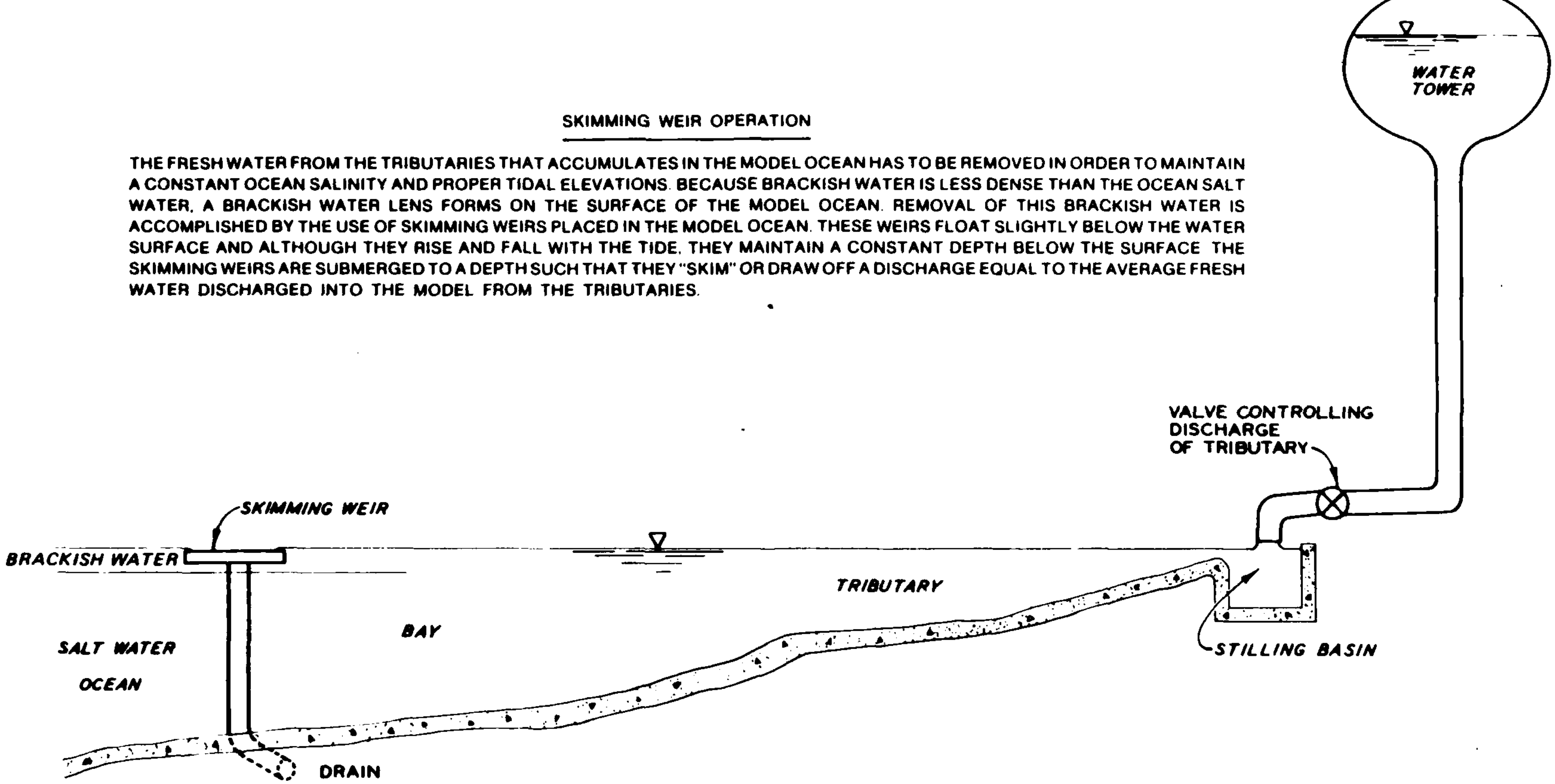


FIGURE C-4 SKIMMING WIER OPERATION

TIDE GAGES

Permanently mounted point gages were installed in the model to correspond to the 75 prototype tide stations shown in Figure C-2. These gages, graduated to 0.001 ft (0.1 ft prototype), are used for the manual measurement of tidal elevations. A typical point gage is shown in Figure C-5.

WATER LEVEL DETECTORS

Ten high precision water-level measuring instruments were designed and built at the Waterways Experiment Station (WES) for the Chesapeake Bay Model. Specifications for these units were displacement range 0.5 ft, accuracy 0.003 in., resolution 0.005 in., and temperature range 32-110^{o}F. Commercial units were not available that met these specifications. The sensors were basically an air capacitance system consisting of a stainless-steel probe, a closed loop servosystem, and a capacitance transducer to convert a specified distance (the air gap between the probe and the water surface) into a d-c voltage. This voltage, in conjunction with the servosystem, maintained a constant air gap. The servomechanism used a precision slide table with a stepping motor. The movement of the slide table and probe were measured by a potentiometer to produce an analog voltage. This voltage was converted to BCD and further converted to serial ASCII for transmission to the computer. This noncontacting sensor technique provided high quality data with minimum maintenance and calibration. A schematic diagram of the system is shown in Figure C-6.

CURRENT VELOCITY METERS

Current velocity measurements were made on the model using miniature Price-type current meters (Figure C-7). The center line of the five cups was about 0.045 ft above the bottom of the meter frame; therefore, bottom velocities in the model were measured about 4.5 ft (prototype) above the bottom. The width of the meter, about 0.1 ft in the model, represented a horizontal width of about 100 ft in the prototype. The height of the meter cups, about 0.04 ft, represented about 4.0 ft in the prototype. The distortion of area (model to prototype) resulted in comparing model velocities averaged over a much larger area than the prototype point observations. Velocities were obtained by counting the number of revolutions the meter wheel made in a 10-sec interval (about 17 min in the prototype). The meters were calibrated frequently to ensure an accuracy of $\pm$0.05 fps (0.5 fps prototype).

VACUUM SAMPLING SYSTEM

The vacuum sampling system consisted of three independent vacuum systems, each designed to sample approximately one-third of the model's 199 collection stations. Each system had a separate pipe network constructed of 1/2-in.-ID polybutylene tubing attached to the shelter trusses. From tees on the 1/2-in. tubing, located over each of the model's collection stations, 1/4-in.-ID polybutylene tubing extended to the model surface. The vacuum line branched into collection jars located on stands at each station. From each jar, a 1/16-in. vacuum line branched into a sample test tube. A 1/16-in. vacuum line then extended to a brass tube which had a port placed at the desired sample depth. Samples were drawn by activating the vacuum system at the selected times required for each specific model test. Following the completion of sampling, test tubes were brought to the laboratory for salinity analysis and dye concentration (if required.)

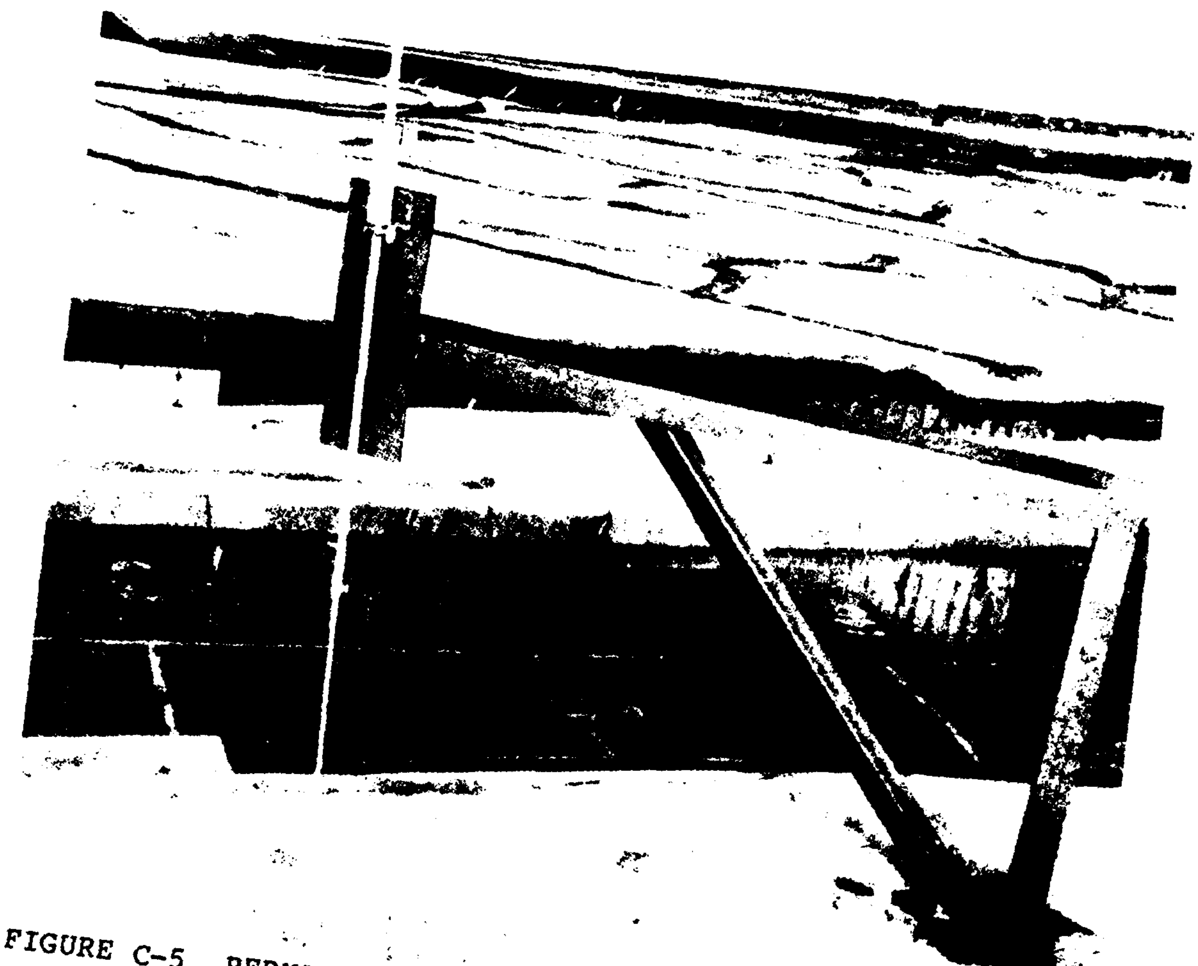


FIGURE C-5 PERMANENTLY MOUNTED POINT GAGE

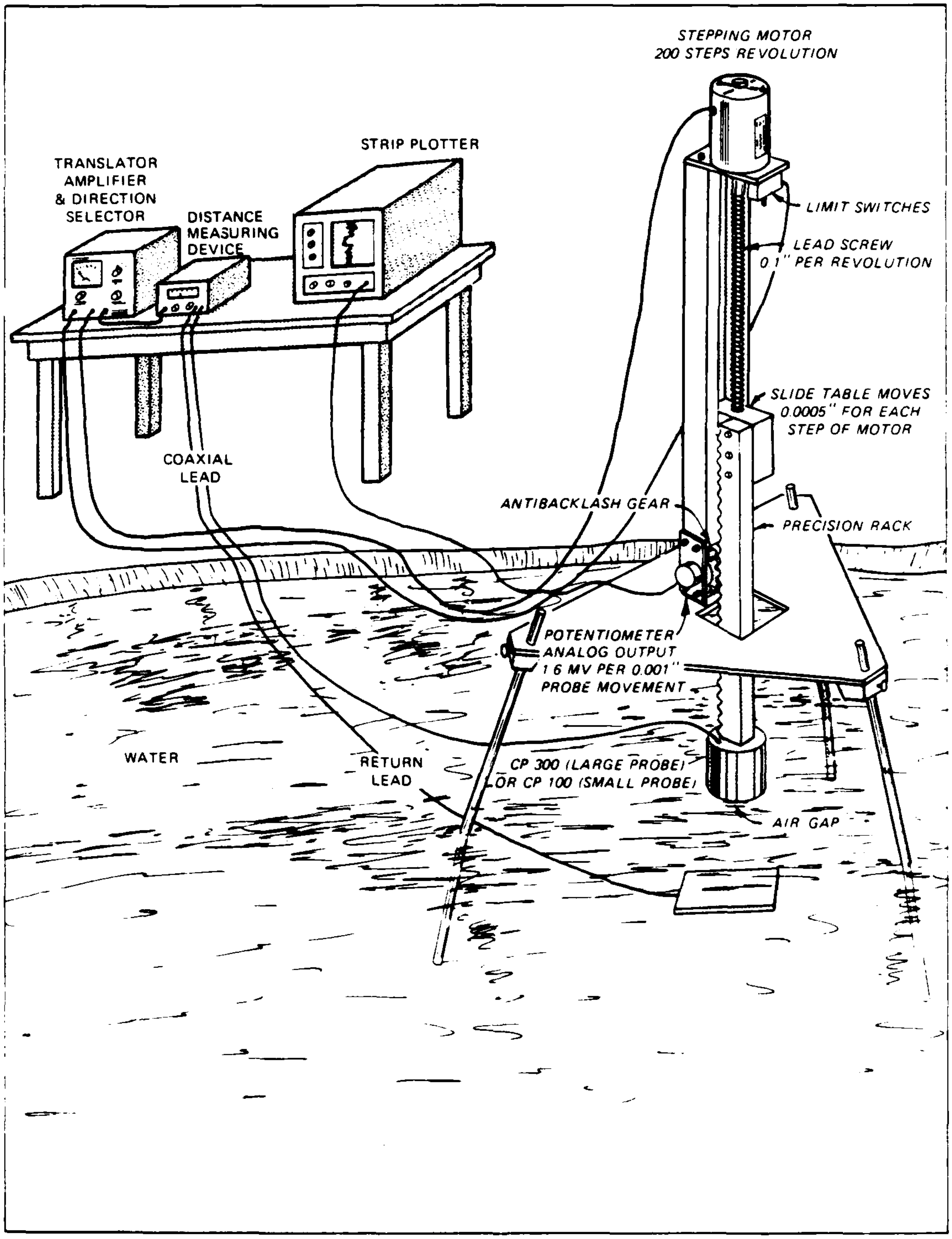


FIGURE C-6 WATER-LEVEL DETECTING INSTRUMENT

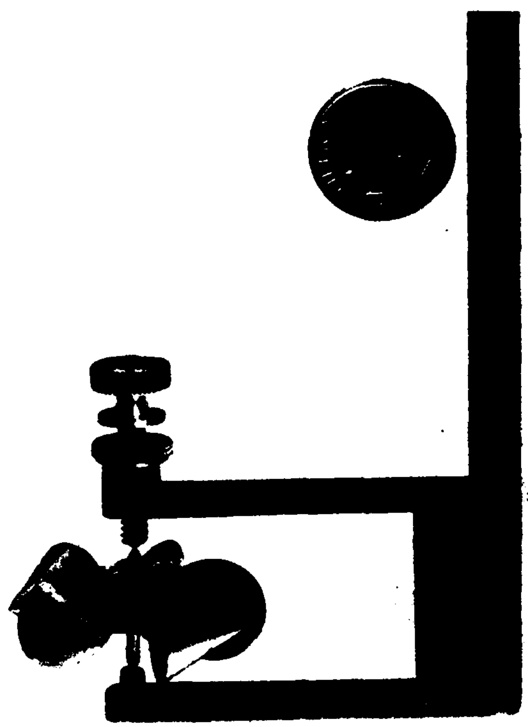


FIGURE C-7 MINIATURE PRICE-TYPE CURRENT METER

SALINITY METERS

Electronic conductivity meters (Balsbaugh 1210 and Beckman RI55) monitored in situ salinity concentrations at specific points on the model and in the supply and return sumps. Beckman RA5 solumeters (Figure C-7) were used for laboratory analysis of samples withdrawn from the model. The Balsbaugh meters employed an oscillator-detector circuit while the Beckman meters employ a Wheatstone Bridge Circuit for conductivity measurements.

MODEL CAPABILITIES

There are six basic measurements that are made on estuarine hydraulic models. These include water surface elevation, salinity, current velocity, dye concentration from dye dispersion tests, temperature, and sediment distribution. These measurements can effectively describe the physical impact on an estuarine resource of many of the works of man. Often biological stress can be predicted from the knowledge of changing physical parameters.

Based on the testing conducted, the capability of the Chesapeake Bay Model to reproduce physical prototype data is generally as follows:

a. Water surface elevation could be measured to 0.001 foot in the model, representing 0.1 foot in the prototype.

b. Current velocity could be measured within ± 0.02 foot per second. This represented 0.2 foot per second in the prototype. Verification procedures indicated that model velocities may vary up to 20 percent from that in the prototype.

c. Salinity was measured in the model to the same accuracy as in the prototype. Model and prototype salinity are in a 1:1 relationship.

d. Dye concentration, from dye dispersion tests, was measured by fluorometric methods to 1.0 ppb. The model can be used to predict the distribution and concentration of conservation water quality constituents to an accuracy of about 20 percent.

e. Temperature could be measured to an accuracy of about plus or minus 0.1 degrees Celsius.

f. For sediment distribution studies, the volume distribution of Gilsonite, or other material simulating sediment, over a specified unit area is a standard measure. This is considered to be qualitative procedure. It should be noted that no sediment distribution studies were conducted on the model.

SHELTER AND MODEL CONSTRUCTION

Because of the hydraulic model's small scale and the resultant precision required in collecting data, the model had to be protected from wind, rain, and windborne debris. The detailed design and the preparation of the plans and specifications for a shelter that houses the model were completed by Whitman, Requardt and Associates in 1972. Subsequently, a contract for the construction of the shelter was awarded to Charles E. Brohawn Brothers, Incorporated, in February 1973 and a formal groundbreaking ceremony was held in June 1973. This ceremony was sponsored by Commissioners of Queen Annes' County. The construction of the 14-acre prefabricated steel truss building was completed in December 1974.

Concurrent with the design and construction of the model shelter, the Waterways Experiment Station (WES) was designing the model and the required hydraulic appurtenances. The model design, which included the design and in some cases fabrication of the various elements of the model's hydraulic system and the plotting of approximately 26 miles of templates, was completed in the summer of 1974. WES conducted the design under a Memorandum of Understanding between the Director, Waterways Experiment Station, and the District Engineer, Baltimore District. The Memorandum also stipulated that WES would construct, adjust and verify, and operate and maintain the model through the testing period.

Construction of the model was started in October 1974 and the approximately 9-acre model was completed in April 1976. A formal dedication ceremony sponsored by the Commissioners of Queen Anne's County was held on 7 May 1976. This dedication ceremony marked the beginning of the adjustment and verification period.

PROTOTYPE DATA

When construction of a model is completed, its operating similarity to an estuary's hydraulic and salinity phenomena must be verified. In order to accomplish this for the Chesapeake Bay Model, an extensive prototype data collection program was conducted. This involved the collection of data concerning tidal elevations, current velocities, and salinities at various points throughout the Bay system. Tidal elevation data were collected at 72 locations for at least one year's duration by the National Ocean Survey (NOS). NOS also conducted a 1,000 mile first order survey to establish a common reference datum for the tidal stations. Current velocity and salinity data were acquired at over 700 different stations for periods ranging from 3 to 5 days. This work was accomplished under contract with the Johns Hopkins University, the University of Maryland, and the Virginia Institute of Marine Science. Figure C-2 shows the locations where prototype data were collected.

MODEL VERIFICATION

Between May 1976 and May 1978 the Chesapeake Bay Model was verified to acceptably reproduce tidal heights, tidal velocities , and salinity distributions. This was accomplished in two phases:

a. Tidal height and tidal velocity verification was achieved by reproduction of the primary lunar astronomical constituent and steady-state inflows. Boundary conditions for this phase of verification included an M_2 source tide at the model ocean and at the C&D Canal, an ocean salinity of 31 ppt (Test 20) and 30 ppt (Test 22), a C&D Canal salinity of 3 to 5 ppt, and a long-term average freshwater inflow at each of the 21 inflow locations on the model.

b. Salinity verification was achieved by the reproduction of a typical 28-day tide sequence, filtered to remove long-period (wind-generated) energy, and long-duration inflow hydrographs. Boundary conditions for this phase included a 28-day ocean tide, a 28-day C&D Canal tide, an ocean salinity of 30 ppt, a C&D Canal salinity of 3 to 5 ppt, freshwater inflow hydrographs at the 21 major tributaries of the Bay, and a bubbler system to statistically reproduce the additional mixing caused by wind stress on the Bay.

A vast amount of time and manpower was expended to ensure the best possible verification of the Chesapeake Bay Model. The fact that the model was the largest physical estuarine model ever built presented many problems which had to be overcome. The difficulties posed by the physical size of the model were solved by an innovative computer control and monitoring system employing instrumentation developed specifically for this model. Problems were encountered, because of the lack of synoptic prototype data, that made conventional model verification procedures impossible. These problems were further complicated by the existence of a substantial amount of wind contamination in the prototype data. The use of digital filtering techniques and the subsequent verification of the model to tidal constituents solved these problems. Numerous model tests were conducted to ensure that the procedures used for verification were valid and would result in a model that was verified to prototype conditions. Based on the results of the verification process, the model was verified and could be used to reliably predict the effects of future changes in the Bay system on tidal heights and velocity and salinity distributions. The model could not, and was not intended to, reproduce the effects of wind-induced surges on the tides, velocities, or salinities; however, the impact of future changes should be based on the deviation from normal conditions instead of extreme conditions.

For a detailed discussion and presentation of the results of the verification testing and methodology, the reader is referred to Technical Report HL-81-14, Verification of the Chesapeake Bay Model prepared by the Hydraulics Laboratory of the U.S. Army Engineer Waterways Experiment Station (WES) and dated December 1981. It should also be noted that following rather extensive repairs to the model in 1981 the model underwent an extensive reverification. The results of this reverification are presented in a Technical Report prepared by WES in 1983.

DISPOSITION OF MODEL

As will be discussed in detail in subsequent sections of this supplement, a model testing program was formulated and a substantial portion of that testing program was accomplished. The last hydraulic model test was conducted in January 1982. Following completion of the testing in January 1982, sufficient funding was not available in either the remainder of Fiscal Year 1982 or Fiscal Year 1983 to conduct any additional testing. During this period, the model was maintained in a state of operational readiness in the event Congressional funding materialized or a non-Corps sponsor wished to pay for a test. During the preparation of the Fiscal Year 1984 budget request, consideration was given by the Corps to closing the model and completing the program without any further model testing. After a thorough consideration of the merits of maintaining the model, the Corps recommended to the Congress in February 1983 that the model be closed and that the Bay program be completed by the end of Fiscal Year 1984. After the aforementioned recommendation, Congressman Roy Dyson of Maryland organized an interagency committee to review the closing of the model. After a thorough review of the future need for the model, the committee found that the model was not required for any further testing. The State of Maryland, however, has requested that the property be transferred to the State for use as an educational/tourist center. The State has assumed responsibility for maintenance of the facility pending formal transfer of the property.

FORMULATION OF THE TESTING PROGRAM

Based on the findings of both the Existing Conditions Report and the Future Conditions Report, there are a myriad of either existing or emerging water resource related problems in the Chesapeake Bay Region that require resolution. Dependent on the nature and the Bay-wide significance of these problems, the responsibility for addressing a specific problem and then implementing a solution rests with either the local, state, or Federal government or a combination of various levels of government. In this regard, there are numerous studies and research programs underway at all levels of government that are addressing various Bay-related problems.

In order to select the detailed study and testing program, an analysis was conducted to establish what role the Corps of Engineers Chesapeake Bay Study played within this spectrum of ongoing studies and research. In defining this role, emphasis was placed on (1) selecting problems for study that were considered to be high priority and that have Bay-wide significance, (2) maximizing the use of the Chesapeake Bay Hydraulic Model, (3) avoiding any duplication of work being conducted under other existing or proposed programs, and (4) being responsive to the original intent of the Congress as specified in the study authorization.

Based on the previously mentioned Existing and Future Conditions reports and specific inquiries of potential users, a list of high priority problems that had potential for study and hydraulic model testing was developed and is included as Table C-1. As there was not sufficient time to adequately address all the problems arrayed on this table, the list was screened and the study program was selected based on the criteria discussed in the preceding paragraph. The following paragraphs discuss this selection process in detail.

TABLE C-1
POTENTIAL MODEL STUDIES

ESTUARINE PROCESSES STUDIES

- Low Freshwater Inflow Study
- High Freshwater Inflow Study
- Water Exchange Among Tributaries
- Determination of Circulation Patterns
- Tidal Flooding Study
- Movement of Hydrogen Sulfide in Lower Bay

MUNICIPAL WATER SUPPLY STUDIES

- Potomac River Estuary Water Supply
- Baltimore-Susquehanna River Diversion
- Rappahannock River Estuary Water Supply
- Susquehanna-Potomac Water Diversion
- Upper James River (Hopewell and Richmond) Water Supply
- James-Appomattox Diversions
- James-York Diversions

TABLE C-1 (Cont'd)

POWER PLANT EFFECTS STUDIES

Proposed Upper Bay Power Plant Thermal Effects Study
Proposed Lower Bay Power Plant Thermal Effects Study
Upper Bay Power Plants Cumulative Thermal Effects Study
Lower Bay Power Plants Cumulative Thermal Effects Study
Potomac River Power Plants Thermal Effects Study
James River Power Plants Thermal Effects Study
York River Power Plants Thermal Effects Study
Rappahannock River Power Plants Thermal Effects Study

NAVIGATION STUDIES

Baltimore Harbor Channel Enlargement Study
North Bay Dredged Material Containment Area Study
Norfolk Harbor Channel Enlargement Study
South Bay Dredged Material Containment Area Study
Bay-Wide Dredged Material Disposal Study
York River Channel Enlargement Study
Crisfield Harbor Construction Study
Cape Charles Harbor Channel Enlargement Study

WASTEWATER STUDIES

Upper and Lower Bay Wastewater Dispersion Study (EPA)
Potomac River Estuary Wastewater Dispersion Study
Patuxent River Estuary Wastewater Dispersion Study
James and Elizabeth Rivers Wastewater Dispersion Study
Patapsco River Estuary Wastewater Dispersion Study
Back River Wastewater Dispersion Study
Chester River Wastewater Dispersion Study
Choptank River Wastewater Dispersion Study
York River Wastewater Dispersion Study
Rappahannock River Wastewater Dispersion Study
Upper and Lower Bay Nutrient Equilibrium Study

DEVELOPMENT OF NUMERICAL MODELS

Determination of Dispersion Coefficients
Verification of Numerical Tidal Model
Determination of Water Masses in Three Dimensions
Determination of Mass Exchanges at Open Boundaries
Calibration of Numerical Hydrodynamic Model

SEDIMENT TRANSPORT STUDIES

Sediment Transport in Upper Bay
Sediment Transport in Potomac River Estuary
Sediment Transport in Rappahannock River Estuary
Sediment Transport in York River Estuary
Sediment Transport in James River Estuary
Sediment Transport in Chester River Estuary

INITIAL MODEL TESTING PROGRAM

The initial screening of the potential model studies listed on Table C-1 was conducted in concert with the Advisory Group and the Steering Committee and assumed there would only be a one-year testing program. It was furthur assumed that the Chesapeake Bay Study would terminate after the initial year of testing and that no in-depth analysis would be made of the data collected. Given the large number of potential studies, it became necessary to conduct a formulation exercise to select a testing program. One element of the formulation process was to assign a priority to each individual study to insure that the one year of available testing was used in the most productive and economic manner. The priority rating was established based on the probable environmental, social and economic impacts of the various problems that would be addressed through each potential test.

Each problem impact category (i.e., environmental, social, and economic) was rated by estimating both its magnitude and severity. The magnitude of an environmental impact was based on the area of the Chesapeake Bay system affected. Social and economic impact magnitude was expressed in terms of the number of people affected. Problem severity for each problem impact category was expressed as an estimate of the intensity of the insult. The numerical index value of problem magnitude and severity for each impact category (environmental, social, and economic) was based on an ascending scale of 1 to 5. The number 1 indicated a mild impact—the number 5 indicated a severe impact.

Given the aforementioned priority rating system which is explained in detail in Supplement A, the potential model studies were evaluated and an overall rating was assigned to each study. Table C-2 lists the ratings that were assigned to each study. It should be emphasized that the ratings were subjective and all but meaningless standing by themselves; however, the ratings did serve as one means of comparing the various studies. In addition to the above impact ratings, the following criteria were also used in the decision process.

a. The importance of the particular study to the Corps' Chesapeake Bay Study.

b. The formulation of a hydraulic study program that could be completed within the funding and time constraints of the presently authorized Chesapeake Bay Study, and that most economically uses the available resource, e.g., labor, instrumentation, etc.

c. Hydraulic studies that were not only necessary at that time, but may be of use in the future.

d. Hydraulic studies that demonstrate the utility and versatility of the hydraulic model.

e. The demand for a particular study by other public agencies or interested groups.

The list of studies was then examined in light of the foregoing criteria for the purpose of selecting those study problems that should be accomplished during the first year of model testing operations. The selected first year program consisted of the following studies.

TABLE C-2
PROBLEM IMPACT INDICES*

Technical Problem Areas (1)	Environmental Impact Indices Severity (2)	Magnitude (3)	Social Impact Indices Severity (4)	Magnitude (5)	Economic Impact Indices Severity (6)	Magnitude (7)	Indices Total (8)
a. Bay Wide General Tests							
1. Low Freshwater Inflow Study	3	5	3	4	2	4	21
2. High Freshwater Inflow Study	2	5	3	4	2	4	20
3. Tidal Flooding Study	2	5	3	4	3	4	21
B. Municipal Water Supply							
1. Potomac River Estuary Water Supply Study	2	2	4	4	2	2	16
2. Baltimore-Susquehanna River Water Supply Division	1	3	1	4	1	4	14
C. Power Plant Thermal Discharge Studies							
1. Proposed Upper Bay Power Plant Thermal Effects Study	3	1	2	5	2	5	18
2. Cumulative Lower Bay Power Plant Thermal Effects Study	3	1	2	5	2	5	18
3. Cumulative Upper Bay Thermal Effects Study	3	3	2	5	2	5	20

*1- minor impact to 5- severe impact

TABLE C-2 (cont'd)
PROBLEM IMPACT INDICES

Technical Problem Areas (1)	Environmental Impact Indices Severity (2)	Environmental Impact Indices Magnitude (3)	Social Impact Indices Severity (4)	Social Impact Indices Magnitude (5)	Economic Impact Indices Severity (6)	Economic Impact Indices Magnitude (7)	Indices Total (8)
D. Navigation Studies							
1. Baltimore Harbor Channel Enlargement Study	3	3	3	4	4	4	21
2. North Bay Dredged Material Disposal Study	5	1	3	4	4	4	21
3. Norfolk Harbor Channel Enlargement Study	3	2	3	3	4	3	18
4. South Bay Dredged Material Disposal Study	4	1	3	3	4	3	18
5. York River Channel Enlargement Study	3	1	3	1	3	1	12
E. Waste Water							
1. Potomac River Estuary Waste Water Dispersion Study	3	2	3	4	1	4	17
2. Patuxent River Estuary Waste Water Dispersion Study	3	1	3	2	1	2	12
3. James and Elizabeth Rivers Estuaries Waste Water Dispersion Study	3	2	3	4	1	4	17
4. Patapsco River Waste Water Dispersion Study	3	2	3	4	1	4	17
5. Back River Waste Water Dispersion Study	3	1	2	4	1	2	13

1. Low Freshwater Inflow Study. The purpose of this investigation was to study the effects on the salinity regime of the Chesapeake Bay system of decreased freshwater inflows due to drought and man-related modifications.

2. Baltimore Harbor Study. This work defined the effects on the estuarine system of deepening the Baltimore Harbor channels to a depth of 50 feet. Included were studies concerned with rates of harbor flushing, dispersion of wastes, salinity intrusion, and changes in shoaling rates and patterns.

3. Potomac River Estuary Water Supply and Wastewater Dispersion Study. This study was designed to explore the ramifications of using the Potomac River Estuary as a supplemental source of water supply for Washington, D.C. One of the primary concerns regarding using the estuary as a source of water supply was the possibility of recycling wastewater into the water supply intake system during periods of low freshwater inflow and the possibility of changing salinity levels and current patterns in the Potomac Estuary.

EXPANDED STUDY PROGRAM

During the selection of the above first year program, it became apparent that there were many problems in the Chesapeake Bay which could be solved only in the context of a hydraulic model studies program far beyond that which could be accomplished in a one year period. It was also apparent that if such a model studies program were undertaken, it should be formulated in the context of a resources study which would provide for the development of a meaningful and properly prioritized hydraulic model studies program. Further, the model studies data should be used in the resources study as an aid in formulating problem solutions. In 1975 the Corps prepared a revised scope of work recommending an expanded study program and a total of four years of model testing.

Following approval of the concept of an expanded study and model testing program, a study program was selected and documented in the Revised Plan of Study published in October 1978. In selecting the study program recommended in the October 1978 Revised Plan of Study, the potential study candidates listed in Table C-1 were again reviewed. Based on this review, it appeared that at least a portion of the future study and model effort to be funded by the Chesapeake Bay Study should be directed toward studies of extraordinary natural events that have Bay-wide impact or significance.

More specifically, these rare natural events included:

1. Periods of prolonged low freshwater inflow from the Bay's tributaries.

2. Periods of high freshwater inflow from the Bay's tributaries.

3. Tidal flooding caused by unusual climatological/meteorological conditions.

In considering the advisability of conducting additional studies of these rare events, the following points were considered to be pertinent.

1. These events all have significant Bay-wide impacts on the natural resource.

2. The impacts of these rare events are intensified because of man's use of the Bay and its resources.

3. There is a lack of data/understanding of the physical changes that occur in the estuarine system as a result of these rare events. Further, the impact on both the resource itself and man's use of the resource is not well defined.

4. There is no existing Federal or state program that is addressing the nature and impact of these rare events on a Bay-wide basis.

5. The problems and resource conflicts associated with these events have all been ranked as high priority by the Advisory Group and the Steering Committee.

6. All of these rare events may be duplicated and evaluated using the Chesapeake Bay Hydraulic Model.

Based on the above considerations, there appeared to be strong justification for conducting comprehensive studies of these rare events as part of the expanded study program.

A further review of the potential tests listed in Table C-1 yielded some additional candidates for study under the expanded program. Chief among these candidates were the Bay-wide Nutrient Equilibrium Study and the Bay-wide Dredged Material Containment Study. While these two studies would definitely be addressing problems that have Bay-wide significance, they were not considered to have as high a priority as those previously mentioned. In addition, both of these studies had some potential for overlap with existing programs.

An additional factor that had to be considered in the analysis was the testing to be conducted for and funded by others. While the model time required to conduct tests for others could have had a significant bearing on the amount of testing that could be conducted in support of the expanded program, it was considered essential that the model be made available to others as directed in the study authorization.

The use by others was expected to greatly enhance the credibility of the model as a planning tool. Based on prior requests from others, it was assumed for the analysis that the following tests had the highest potential for conduct in the extended program period.

1. Upper Bay Proposed Power Plant Thermal Effects Study
2. Upper Bay Power Plants Cumulative Thermal Effects Study
3. Wastewater Dispersion Testing Related to the EPA Bay Study

It was assumed that all of the tests performed for other organizations would be oriented to solving high priority problems of widespread impact and that the data obtained from these tests would be of value to the Chesapeake Bay Study. In these cases, the costs would be shared by the Chesapeake Bay Study and the requesting organization with the terms of cost sharing varying with the nature of the study. In most foreseeable instances, the Chesapeake Bay Study would fund the fixed maintenance costs of the model, shelter, and grounds, while the requesting organization was to pay the costs of preparing and operating the model, collecting data, analyzing the data, preparing the reports and the materials needed for the test.

Any tests conducted for organizations other than the Corps of Engineers required approval of higher authority. If approved and if it required complete devotion of the

model, the cost of the test had to be assumed by the requesting organization. If one of these type tests was performed simultaneously with a Corps test, the requesting agency had to pay its fair share for the use of the model.

Regarding the funding to be provided by others for model testing, the requesting agency was required to provide written assurances that they would provide their share of the model testing funds. Cost sharing agreements/assurances were consummated prior to the submission of the Corps' budget request for the fiscal year in which the testing was to be conducted.

The primary criteria used in setting testing priorities for others was related to the scope and severity of the problem that the test was expected to address and the various scheduling constraints of both the Corps and the requesting agency. Those tests which addressed Bay-wide problems and were considered to be of a serious or severe nature were given a higher priority than those which were related to localized problems.

The time required to conduct both the initial testing program and the tests specifically requested by others was such that the time remaining in the testing period was not sufficient to warrant consideration of any tests in addition to those discussed in the preceding paragraphs. Given the initial program, the work for others, and the five potential studies, the next step in the selection process was to formulate an optimum extended program that was responsive to the criteria established for that analysis and that also provided ample opportunity for testing by others.

The testing program identified in the first screening appeared to be valid; however, a modification to the Low Freshwater Inflow Test enhanced the compatibility of this test with the work contemplated in the expanded program. This test was expanded to provide the initial data needed for a comprehensive Low Flow Study which was considered to be the highest priority study in the extended program. While extending the length of the Low Freshwater Inflow Test, the Potomac Estuary Test could still be conducted in time to provide the required input to the Metropolitan Washington Area Water Supply Study.

Proceeding in this manner appeared to be very attractive in that it did not disrupt the work accomplished to date on the initial program, yet it provided data that would be of immediate use in the expanded program. The initial program as reformulated above required nearly two years of model testing.

Following the above tests, the next two tests from a priority standpoint were the series of Thermal Effects Tests requested by the State of Maryland and the Tidal Flooding Test which would be required in support of a comprehensive Bay-wide Tidal Flooding Study. As the Thermal Effects Study was considered to be of slightly greater importance and all tests to this point in the program were Corps funded, it was considered desirable to conduct the Thermal Effects Test before the Tidal Flooding Test. The addition of these tests raised the total model testing time to approximately 2 years and 9 months.

With the addition of the two preceding tests, approximately 8 months of testing time remained within the testing program. The tests remaining for consideration in the program included the High Freshwater Inflow Test, the Dredged Material Containment Area Test, the Nutrient Equilibrium Test and the EPA Wastewater Dispersion Testing. Of these four remaining tests, the High Freshwater Inflow Test and the EPA Wastewater Dispersion Testing were considered to have the highest priority. Since the scope of the EPA testing and a commitment from EPA were not available at the time, the High

Freshwater Inflow Test was to be conducted following the Tidal Flooding Test. The remaining 3 months of the four year testing program was tentatively scheduled for the EPA tests. In the event a testing program could not be developed in concert with EPA, the remaining testing period was to be used for either of the two remaining tests. It was considered to be premature at that time to assume that any particular test would be substituted for the EPA testing.

Based on the formulation process explained in the preceding paragraphs of this analysis, it was recommended that the expanded Chesapeake Bay Study and Testing Program be composed of the following studies:

1. Baltimore Harbor Channel Enlargement Test
2. Comprehensive Low Freshwater Inflow Study and Testing
3. Potomac River Estuary Water Supply and Wastewater Dispersion Test
4. Proposed Upper Bay Power Plant Thermal Effects Test
5. Upper Bay Cumulative Thermal Effects Test
6. Tidal Flooding Study and Testing
7. High Freshwater Inflow Study and Testing
8. Bay-wide Wastewater Dispersion Test (EPA)

HYDRAULIC MODEL TESTING

For a variety of reasons the testing program was not conducted as originally proposed in the 1978 Revised Plan of Study. Several tests which were generally of limited time and scope were added to the program. Also, as a result of funding limitations, several of the proposed major tests were not conducted. Included as Table C-3 is a listing of all the testing conducted on the model and for whom the test was conducted. The following paragraphs provide a general description of each of the tests conducted.

CORPS OF ENGINEERS' TESTING

BALTIMORE HARBOR AND CHANNELS DEEPENING TEST

Description and Objective of Testing

Public Law 91-611, through Section 101 of the 1970 Rivers and Harbors Act, authorized a plan of improvement to deepen the existing navigation channels to the Port of Baltimore from 42 ft to 50 ft and to extend the channels to the natural 50-ft-depth curves. Tests on the Chesapeake Bay Hydraulic Model were conducted to specifically investigate possible changes in the hydrodynamic characteristics of velocity, salinity, and tidal elevations associated with the proposed channel enlargements. Changes in these parameters can result in changes to estuarine circulation and dynamics, sedimentation rates and patterns; can affect biological communities and distributions; and can affect dispersion of pollutants and nutrients.

TABLE C-3
TESTS CONDUCTED ON CHESAPEAKE BAY HYDRAULIC MODEL

Test	Agency/Supporting Program
1. Baltimore Harbor Channel Enlargement Test	Baltimore District, Corps of Engineers - Baltimore Harbor Study
2. Nanticoke River Toxic Material Dispersion Test	State of Maryland - Sharptown Toxic Waste Study
3. James River Oil Dispersion Test	Corps of Engineers - Hampton Roads Refinery Permit Application
4. Cuyahoga Victim Recovery Test	U.S. Coast Guard - Victim Recovery Operations
5. Patuxent and Chester River Prototype Survey Design	Univ. of Maryland - Patuxent and Chester River Studies
6. Lafayette River Wastewater Dispersion Test	Old Dominion University - Lafayette River Marina Study
7. Low Freshwater Inflow Problem Identification Test	Baltimore District, Corps of Engineers - Chesapeake Bay Study
8. Potomac Estuary Water Supply and Wastewater Dispersion Test	Baltimore District, Corps of Engineers - Metro Wash. Water Supply Study
9. Storm Surge Test	Baltimore District, Corps of Engineers - Chesapeake Bay Study
10. Norfolk Harbor Channel Deepening Test	Norfolk District, Corps of Engineers - Norfolk Harbor Study
11. Air Florida Debris Recovery Test	Baltimore District, Corps of Engineers - Debris Recovery Operations

The investigation included a series of base tests using the verified model with the existing Baltimore Harbor and approach navigation channels at 42 ft plus a 2-ft dredging tolerance. After these tests were completed, the channels were remolded to the new authorized 50-ft depth plus a 2-ft dredging tolerance, and a series of compatible plan tests were similarly performed for comparison purposes.

Two separate modes of model operation and testing were followed. In the first mode, velocity measurements were undertaken at 13 selected stations during four separate steady-state tests utilizing fixed boundary conditions. In the second mode, salinity and tide-height measurements were collected at 68 and 10 locations, respectively, during the dynamic conditions associated with a repetitive 28-lunar-day variable tide sequence and a 2-1/2-year freshwater discharge hydrograph.

Model Test Conditions

Model Geometry

For the base condition testing, the model geometry was maintained as constructed and verified. For the plan testing, the authorized channel depths (50 feet) to include 2 feet of overdepth dredging were added to the model.

Tide Conditions

For the steady state testing, the ocean boundary for each test was a cosine tide with either a neap (2.55 feet) or spring (3.75 feet) range. A cosine tide was also generated at the Delaware end of the C&D Canal to achieve the mean tide range of 2.75 feet at Chesapeake City. The tide plane was adjusted to maintain a zero net flow of water through the C&D Canal.

For the dynamic testing, a reconstructed, 12-constituent, 28-lunar-day source tide was repeatedly generated from the ocean tide generator. This tidal sequence included two spring tides (a high and a low spring) and two nearly equal neap tides. An illustration of this tide is on Figure C-8. A compatible 5-constituent, 28-lunar-day source tide was generated concurrently from the C&D Canal tide generator.

Freshwater Inflow Conditions

The steady state testing used a constant total Bay inflow of either 30,000 or 120,000 cubic feet per second (cfs). The distribution of the above flows to the 21 inflow points was based on the long-term average inflows as determined by the Baltimore District.

For the dynamic testing, a hydrograph simulating prototype weekly average flows for the period April 1964 through September 1965 was used. This drought or low-flow period was followed by an average year hydrograph.

Ocean Source Salinity

The model ocean salinity was maintained within acceptable limits of the desired 32.5 ppt throughout both the base and plan testing.

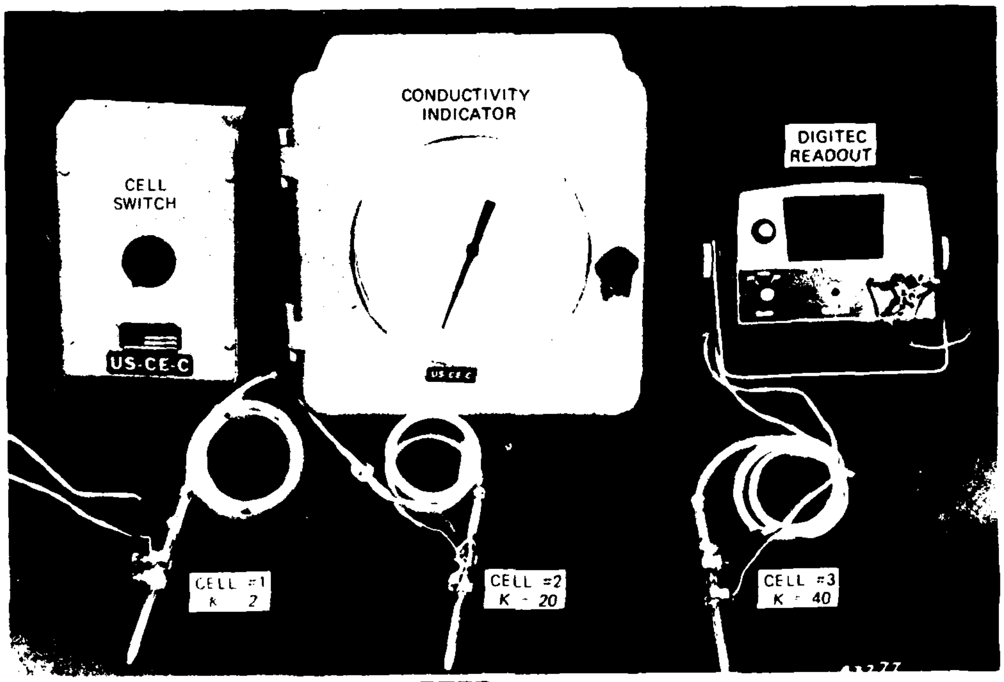


FIGURE C-8 SALINITY METER

Data Collection

Steady State Velocity Testing

Once appropriate boundary conditions were established, salinity monitoring was begun at 11 salinity monitoring stations (Figure C-9) to assess when a stable salinity distribution (the same salinity profile from one tidal cycle to another) was reached. Once a relative stability was achieved, velocity measurements were taken at the 13 designated velocity stations (Figure C-10) for bottom, middle, and surface depths. Seven of the thirteen stations were within the dredged channels (CPH-1, CB-1-5, YSC-4, RSC-2, CC-2, BC-4, and FM-1), four stations were positioned in potential dredged material disposal areas (OD-1, OD-2, OD-3, and OD-4), and two stations were located adjacent to channels to be deepened (YSC-1, and BC-2). Sampling depths at the seven deepened channel stations were adjusted for the plan test to maintain the same relative sampling depths within the water column.

Dynamic Salinity and Tidal Height Testing

Ten automatic water-level detectors were located at key stations throughout the model (Figure C-9). Water-level elevations were recorded at hourly prototype intervals (every 36 seconds, real time).

Salinity sampling at the 68 designated test stations (Figure C-11) began on lunar day 168, following 6 months of dynamic lead-in conditions. Slack-after-flood samples were collected at tides 1, 15, 28, and 44 of each 56-cycle sequence. These tides corresponded to the neap and spring events. To obtain ranges of salinity, slack-after-ebb samples were collected four times during both water year 1965 and the average water year. Stations were sampled at two to five depths, depending on local water depths. Bottom sampling depths were adjusted accordingly to maintain the same relative sampling depth for the plan test at those stations located in areas of bathymetric change. All other sampling points remained in place.

Summary of Test Results

No major plan-to-base velocity differences were apparent in the steady-state comparisons; however, slight trends in velocity characteristics may indicate subtle variations in the hydrodynamics of the system. A small shift in flow distribution (slightly higher flood and lower ebb velocities in the plan tests than the base tests) at lower Bay stations (below the Potomac River) indicates the possibility of additional salt intrusion into the main estuary along the deepened channel. No shift in flow distribution was identified for upper Bay or Patapsco River stations that could be used to substantiate or refute changes to, or the presence of, a two- or three-layer flow circulation pattern.

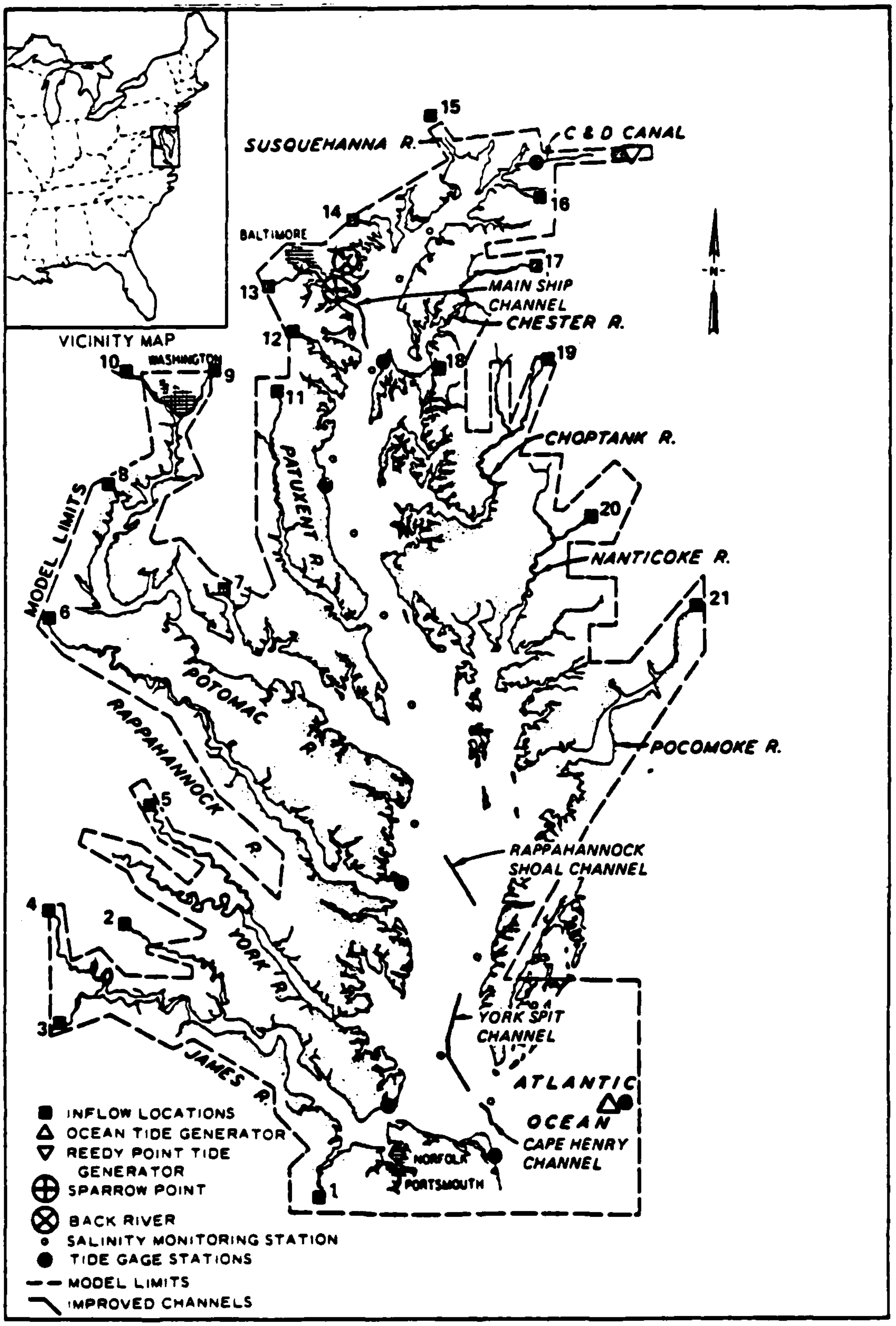


FIGURE C-9 SALINITY AND TIDE GAGE STATIONS

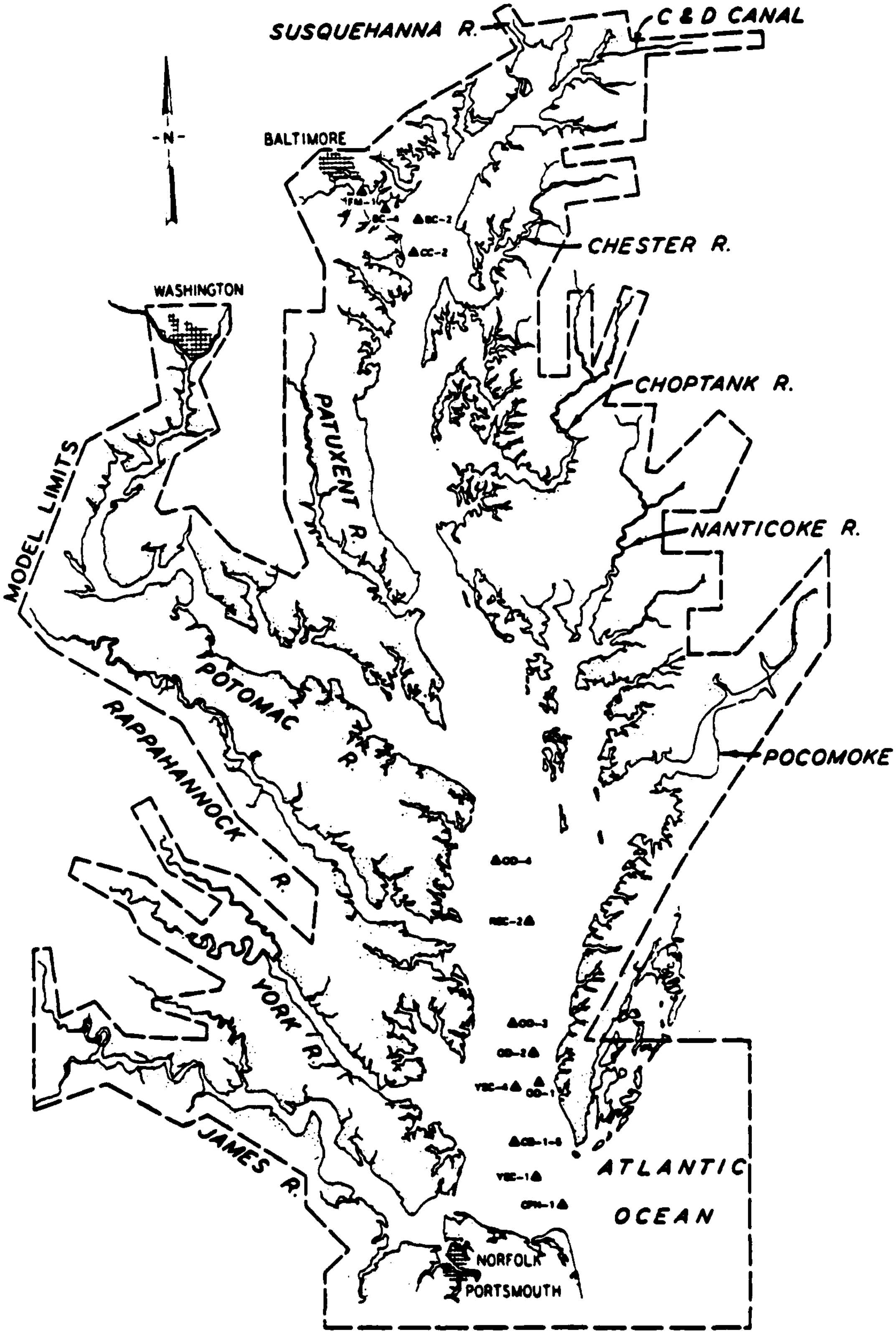


FIGURE C-10 VELOCITY SAMPLING STATION LOCATION MAP

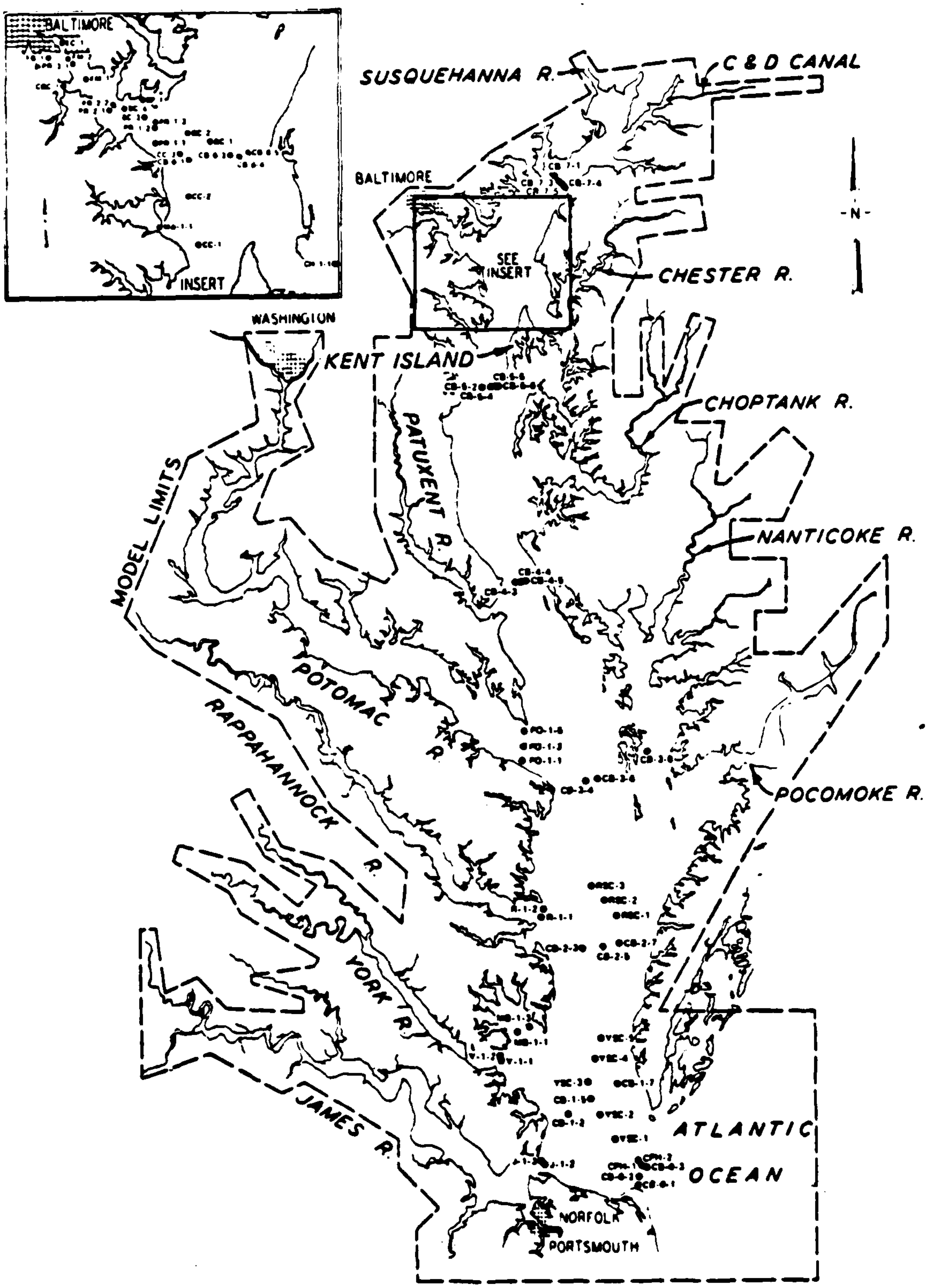


FIGURE C-11 SALINITY SAMPLING STATION LOCATION MAP

Salinity differences associated with channel deepening are noted when comparing the dynamic base and plan tests. For the purposes of this study, stations demonstrating "appreciable" plan-to-base salinity differences are defined as those stations with 10 percent or more of their surface, middle, or bottom depth comparison values greater than ± 2 ppt. Main Bay stations below Kent Island indicate a slight trend of saltier deep water during the plan test although plan minus base differences are not generally greater than the defined appreciable level. Stations in the Bay entrance and York Spit Channel area are the only lower main Bay stations to indicate appreciable differences, generally with saltier surface values during the plan test. The James and York Rivers indicate appreciable salinity intrusion decreases during the plan test.

Salinity differences were found at upper Bay stations above Kent Island. The water column during the plan test is more stratified with fresher surface values and saltier mid-depth and bottom values compared with the base test. Plan minus base differences increase progressing up the deepened channel in the main upper Bay and the Patapsco River. The largest salinity variations occur in the deepened Patapsco River channel where more than 55 percent of the bottom values increased by more than 5 ppt with the largest increases greater than 10 ppt. Salinity differences were found to decrease with distance from the deepened channels and at shallower water stations.

For a more detailed discussion of the model test and the results the reader is referred to Technical Report HL-82-5, Baltimore Harbor and Channels Deepening Study prepared by the Hydraulics Laboratory, U.S. Army Engineer Waterways Experiment Station.

LOW FRESHWATER INFLOW PROBLEM IDENTIFICATION TEST

Description and Objective of Testing

The Problem Identification Test was designed as one of three Low Freshwater Inflow Tests that were to provide information on the changes in circulation patterns, water surface elevations and salinity patterns that may occur in the Bay as a result of reductions in freshwater inflow.

The following objectives were established for the Problem Identification Test:

1. To define salinity patterns throughout the Bay and its tidal tributaries resulting from both historical and projected drought conditions.

2. To define the time it takes for Bay salinities to return to "normal" following a drought condition.

3. To determine the effect of consumptive losses on average year salinities.

4. To provide the hydrodynamic data necessary to develop salinity-inflow relationships.

The primary purpose of the test was to determine how future consumptive uses of water would affect both drought and long term average salinities throughout the Bay system. In order to accomplish this, the test was divided into two parts; a base test and a futures test. In the base test, the freshwater inflows that occurred during the 1964 - 1966 drought were simulated. The drought was followed by several repetitions of an average inflow year.

In the futures test, both the drought and average year inflows were reduced by an amount equivalent to the projected year 2020 future consumptive water use. By comparison of the data between the two tests, the effects of consumptive uses on salinities could be determined.

Model Test Conditions

Model Geometry

The model geometry was maintained as constructed and verified with the addition of the proposed 50-foot Baltimore Harbor and approach channels.

Tidal Conditions

Ocean tides for this testing consisted of a repetitive, 28-lunar-day, 56-cycle tide sequence based on historical records at Old Point Comfort, Virginia.

Chesapeake and Delaware Canal

The Canal and the Delaware source tide was not used for two reasons. First, available prototype data are inadequate to define the amplitudes and periods of the source tide and salinity under variable tidal conditions in Chesapeake and Delaware Bays. Second, previous testing in the model had shown that the hydrodynamics of the C&D Canal are very sensitive such that even minor discrepancies in boundary control can have a significant impact on canal hydrodynamics and thus on salinities in the Upper Bay. Since the boundary control for the source tide in Delaware Bay was not capable of preventing small discrepancies in water-surface elevation, it was decided not to reproduce the source tide for these tests so that any changes in Upper Bay salinities from the base test to the futures test would not be erroneously affected by possible discrepancies in boundary control.

Freshwater Inflows

Freshwater inflows were simulated on the model at the 21 inflow points shown on Figure C-12. The flow from all 21 points represented the total runoff that would have occurred in nature for the entire Bay area. The 1964-1966 drought was simulated on the model using average weekly flows. Consequently, the flow at each inflow point was varied every 1.68 model hours or 7 days prototype. The hydrograph of long term average flows which followed the drought hydrograph was also varied on a weekly basis. The drought hydrographs for both the base and futures tests were adjusted to reflect the influence of all major dams completed since 1966 or that were under construction at the time of the testing. Those under construction included Raystown on the Susquehanna River, Bloomington on the Potomac, and Gathright on the James River.

Sewage Treatment Plant Inflows

Flows from sewage treatment plants (STP) were modeled at eight locations during the base test and 13 locations during the futures test as shown on Figure C-13. These flows were steady state and represented the average yearly discharges of each plant. In areas where there were several small STP's located in close proximity, the flows were accumulated and simulated in the model at one discharge point. The discharge at each point, which is also shown on Figure C-13, was held constant throughout each test except

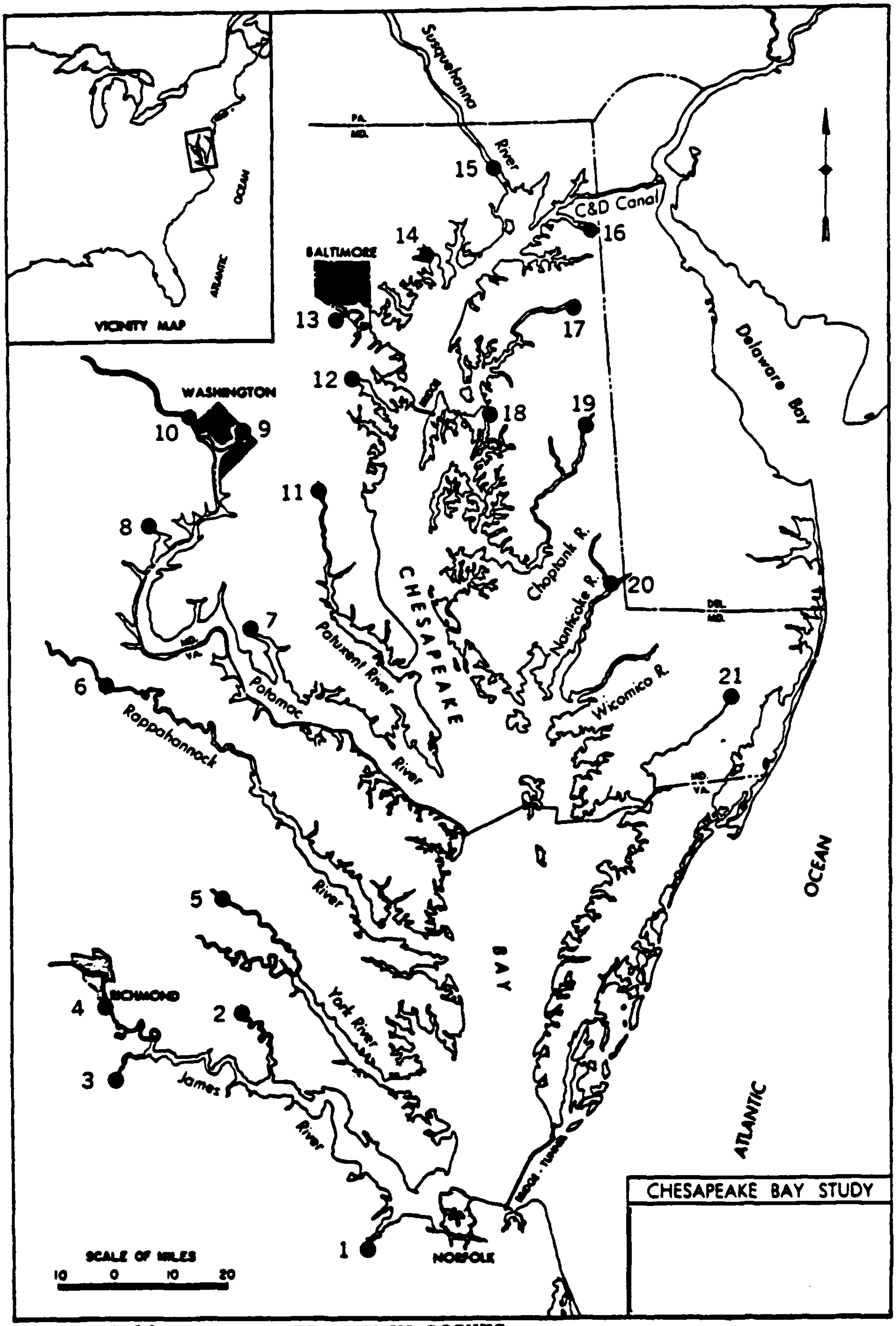
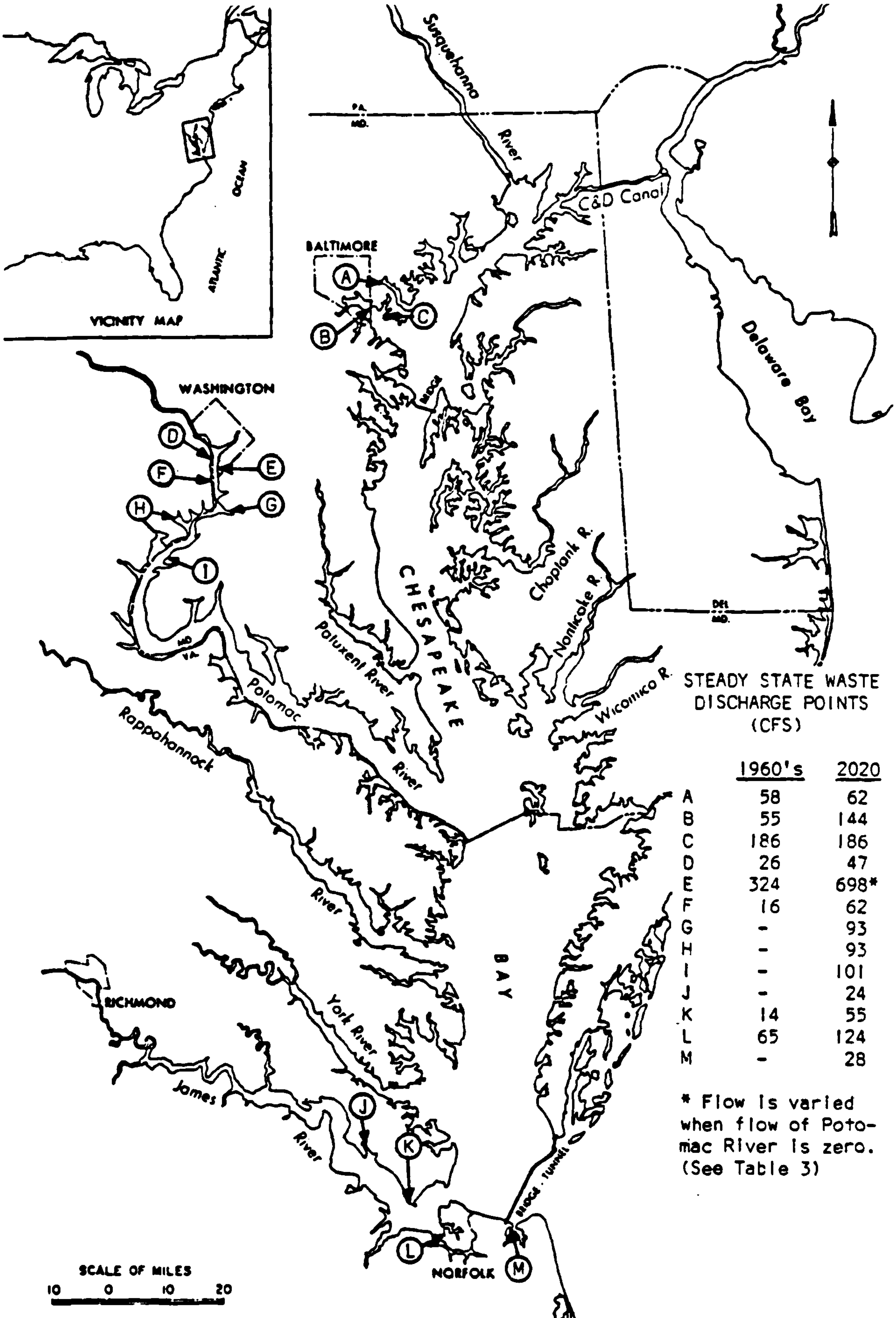


FIGURE C-12 FRESHWATER INFLOW POINTS



STEADY STATE WASTE DISCHARGE POINTS (CFS)

	1960's	2020
A	58	62
B	55	144
C	186	186
D	26	47
E	324	698*
F	16	62
G	-	93
H	-	93
I	-	101
J	-	24
K	14	55
L	65	124
M	-	28

* Flow is varied when flow of Potomac River is zero. (See Table 3)

FIGURE C-13 STEADY STATE WASTE DISCHARGE POINTS

for the Blue Plains Plant on the Potomac River during the futures test. In this case, since the demand for Washington, D.C. exceeded all existing supplies including the total flow of the Potomac River, the flow of the treatment plant had to be varied.

Ocean Source Salinity

The model ocean salinity was maintained within acceptable limits of the desired 32.5 ppt throughout both the base and futures testing.

Data Collection

During the above testing, tidal elevations, salinities, and velocities were collected at various locations under various collection schedules. Table C-4 provides a general description of the data collected. A more detailed description of data collection procedures is provided below.

Tidal Elevations

Tidal elevations were recorded at 20 locations as shown on Figure C-14. The data were collected every 36 seconds (1 hour prototype).

Salinities

Salinity samples were collected at the stations shown on Figure C-15 at slack before ebb on tides 1, 10, 28, and 48 during each 28-lunar day cycle and on slack before flood once each season for each year.

Current Velocities

Current velocities were recorded during both the base and future tests at the 16 stations listed on Table C-5. Measurements were taken at from one to three depths on one spring and one neap tide. During the drought, readings were taken twice; once during a high flow period (April 1965) and once during a low flow period (June 1965). Readings were taken only once during the long term average portion of the test (April). Data were obtained at hourly intervals over a tidal cycle.

Conduct of Test

Prior to conducting any test, model salinities had to be stabilized. This was accomplished in the base and futures tests by first simulating a steady-state total Bay freshwater inflow of 70,000 cfs. A repetitive tide and a source salinity of 32.5 ppt were maintained at the model ocean.

TABLE C-4
LOW FRESHWATER INFLOW TEST
DATA COLLECTED

Test	Tidal Elevations	Salinity Data	Velocity Data
Phase 1 - Base Test			
Stabilization Steady State	10 Base/Control Stations	(Key stations determined by WES)	
Hydrograph	10 Base/Control Stations	(Key stations determined by WES)	
Drought Hydrograph	20 stations as shown on Figure C-14	All stations Figure C-15 weekly @ slack before ebb, also, selected stations seasonly @ slack before flood	All stations Table C-5 hourly over a spring and neap tide 1965 and one average year
Phase 1 - Futures Test (2020)			
Stabilization Steady State	10 Base/Control Stations	(Key stations determined by WES)	
Hydrograph	10 Base/Control Stations	(Key stations determined by WES)	
Drought Hydrograph	20 stations as shown on Figure C-14	All stations Figure C-15 weekly @ slack before ebb	All stations Table C-5 hourly over a spring and neap tide - 1965 and one average year
Average Hydrograph	20 stations as shown on Figure C-14	All stations Figure C-15 weekly @ slack before ebb	All stations Table C-5 hourly over a spring and neap tide - 1965 and one average year

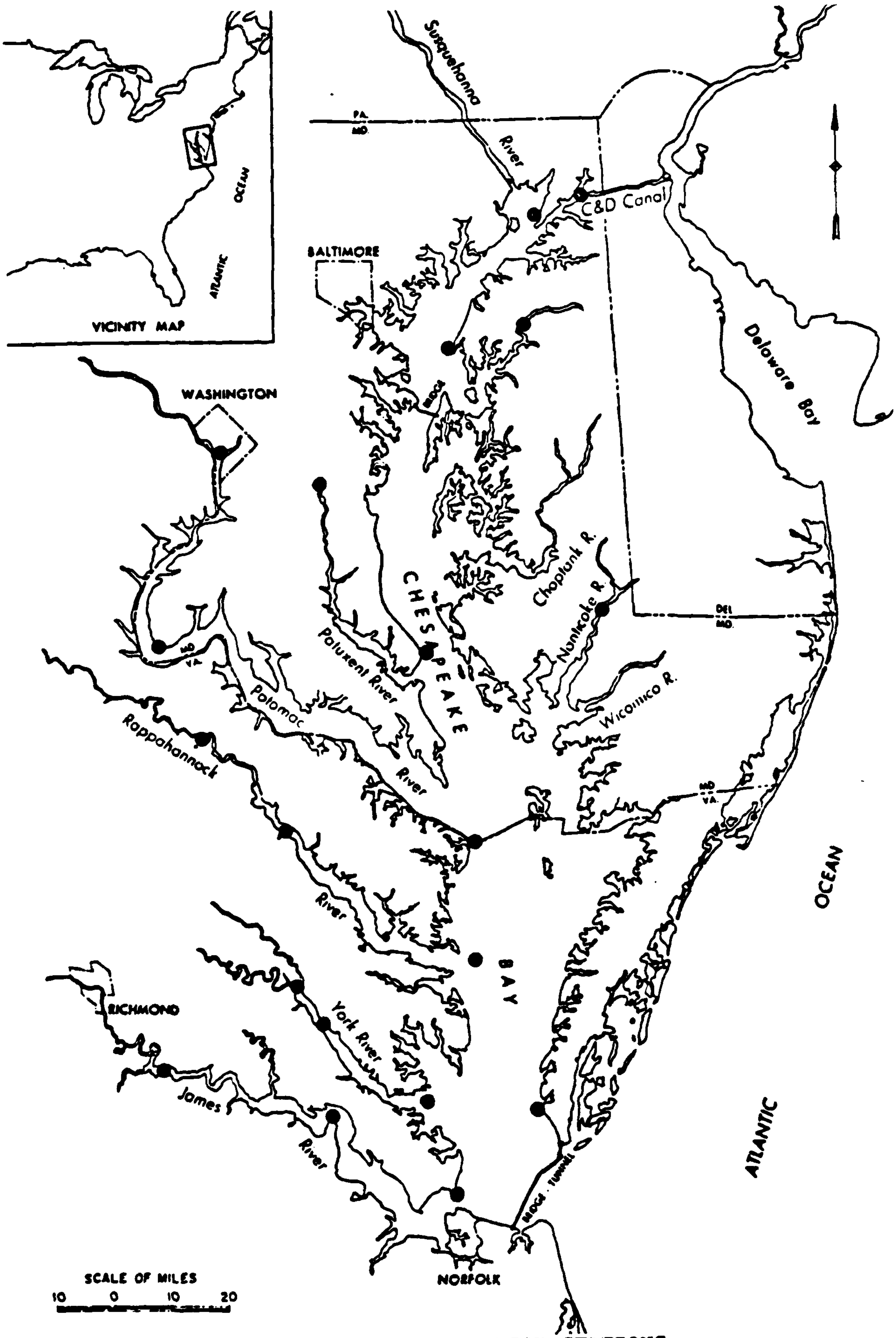


FIGURE C-14 LOCATION OF TIDAL ELEVATION STATIONS

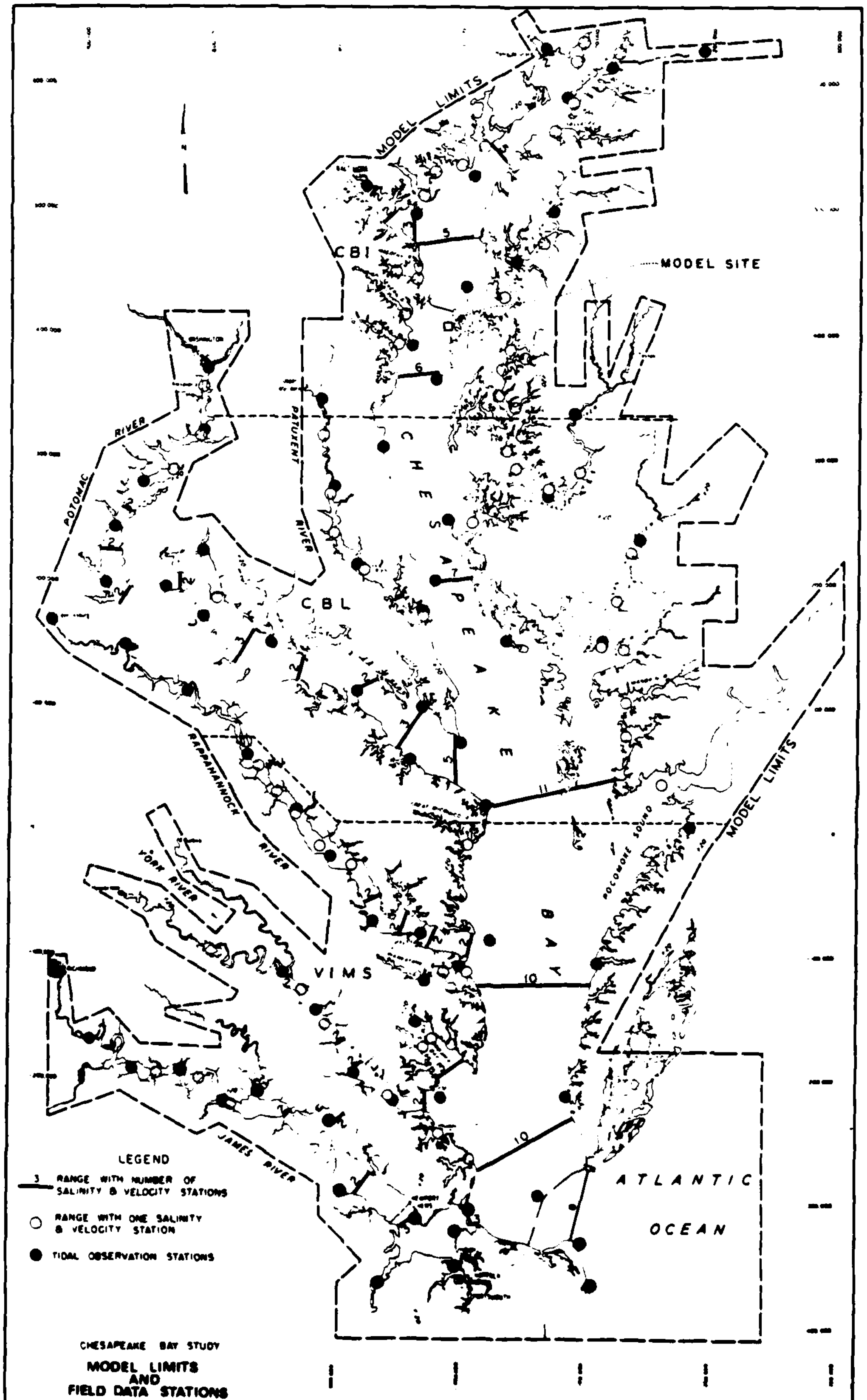


FIGURE C-15 LOCATION MAP SALINITY AND VELOCITY STATIONS

TABLE C-5
LOW FRESHWATER INFLOW TEST
VELOCITY STATIONS

Transect	Number of Station
Chesapeake Bay	
CB-1	3
CB-3	3
CB-5	1
CB-7	3
CB-8	3
Chesapeake and Delaware Canal	
CD-1	1
Potomac River	
PO-9	1
Rappahannock River	
R-9	1

After the model salinity had reached equilibrium under steady-state conditions, the lead-in hydrograph, which simulated flows during water year 1963, was begun. At the same time, the 28-lunar day varying tide was initiated. Ocean salinity was maintained at 32.5 ppt. During the first six months of water year 1963, the influence of the major dams was not included in the inflows. This was done so that model salinities could be checked against prototype data for the corresponding time period to ensure proper simulation of the 1963 flows and corresponding salinities. Salinity distribution during the lead-in period was monitored at 19 strategically located stations to ensure minimal deviation between the base and futures lead-in hydrograph salinities.

Beginning with the second half of water year 1963, the historical flows were adjusted to include the influence of the three major dams previously described. In addition, salinity sampling was initiated at all of the test stations. Actual testing began with the first week of water year 1964 and continued through the week ending 28 September 1966. The drought hydrograph was followed immediately by a hydrograph of long term average flows which was also varied on a weekly basis. The average hydrograph was repeated four times to ensure that the model had returned to a state of "normalcy".

The lead-in conditions for the futures test were identical to the base test. Beginning in the second half of water year 1963, the flows for the futures test were not only adjusted for the influence of the dams, but also were reduced by an amount equal to the incremental increase in consumptive losses between 2020 and those that were already occurring during the 1960's drought. Also at this time, the steady-state waste discharge flows were increased from their 1960's flow levels to projected year 2020 levels. The average yearly hydrograph following the drought was repeated only three times due to a loss of tide control on the model.

The general sequence of inflows for both tests is indicated on Table C-6.

Summary of Test Results

The test results indicate that consumptive losses in general cause a saltier Bay. The magnitude and structural variations in salinity response as a result of consumptive losses are dependent on the specific hydrodynamic characteristics of a sampling area and its proximity to freshwater or saltwater boundary conditions. On the average, however, the stations analyzed responded to consumptive losses with a 1 to 3 ppt saltier future condition. Model sensitivity and repeatability in terms of salinity are thought to be approximately 1 ppt; however, the results are consistent enough to suggest that the 1 to 3 ppt difference is valid with little need to establish confidence limits.

Return to dynamic normalcy is apparently related to the discharge characteristics of the tributary in question. High-discharge rivers such as the Potomac seem to return to the normal range within 100 lunar days. The main Bay also seems to respond quickly to an increase in inflow. Stations near the mouth reach their normal level well within the 100 lunar days required by the higher discharge rivers. Lag times associated with distances from inflow points are overshadowed by the influence of the relative magnitude of the river's discharge.

TABLE C-6
LOW FRESHWATER INFLOW TEST
FRESHWATER INFLOWS

Test	Freshwater Inflows: 21 Inflow Points	Freshwater Inflows: Steady State Wastewater Inflow Points
Base Test (1960's Drought)		
Stabilization Steady State	70,000 cfs	1960's flow levels
Hydrograph	All of Water-Year (WY) 1963: First 6 months, no major dams. Last 6 months, with major dams.	1960's flow levels
Drought Hydrograph	WY 1964 - 1966, with major dams	1960's flow levels
Average Hydrograph	As computed for period of record with several modifications for WTP's and diversions. No major dams. (Repeated 4 times)	1960's flow levels
Futures Test (2020)		
Stabilization Steady State	70,000 cfs	1960's flow levels
Hydrograph	All of WY 1963: First 6 months, same as base test Last 6 months, 2020 consumptive losses, with major dams	First 6 months: 60's flow levels Last 6 months: 2020 flow levels
Drought Hydrograph	WY 1964-1966 Depressed by 2020 consumptive losses and with major dams	2020 flow levels
Average Hydrograph	As computed for period of record depressed by 2020 consumptive losses - No major dams (Repeated 3 times)	2020 flow levels

It is difficult to draw conclusions about dynamic normalcy because the low-flow period immediately preceding the first average year is somewhat mitigated by a small but significant "spike" in inflow. This may have accelerated the model's return to average flow conditions. Of major importance, however, is the indication that inflow perturbations to the system have only transient effects on Chesapeake Bay and that within several months, depending upon location, the Bay can rebound from high saline conditions. In addition, these comparisons give an indication of the high degree of repeatability that can be achieved in the model which is an important consideration when comparing tests with small changes in boundary conditions.

For a more detailed discussion of the entire low freshwater inflow problem and study the reader is referred to the accompaning document titled Chesapeake Bay Low Freshwater Inflow Study. A detailed discussion of the model testing may be found in Technical Report HL-82-3, Low Freshwater Inflow Study prepared by the Hydraulics Laboratory, U.S. Army Engineer Waterways Experiment Station.

POTOMAC RIVER ESTUARY WATER SUPPLY AND WASTEWATER TEST

Description and Objective of Testing

The objective of the Potomac River Estuary testing was to define the salinity regime and wastewater dispersion patterns in the Potomac Estuary under several freshwater inflow conditions and to determine the impact of pumping water out of the Upper Potomac River Estuary at Washington, D.C., upon both salinities and wastewater dispersion patterns.

The testing was to be conducted in two phases. The objective of the base or Phase 1 testing was to define salinity and wastewater dispersion patterns for four freshwater inflows under present (1980) conditions assuming no estuary withdrawal. The objective of the futures or Phase 2 testing was to define salinity and wastewater dispersion patterns for four freshwater inflows under future (2020) conditions assuming estuary withdrawals ranging between 0 and 200 million gallons per day (mgd). Table C-7 lists the inflow and withdr al conditions that were to be reproduced during both the Phase 1 and Phase 2 testing. Unfortunately, because of interruptions for model repairs and reductions in funding for model testing, only eight of the original sixteen tests were conducted. Those conditions tested are noted on Table C-7.

Model Test Conditions

Model Geometry

The model geometry was as constructed and verified with the addition of the proposed 50-foot Baltimore Harbor and approach channels and several minor modifications in the Potomac Estuary.

Tidal Conditions

For each test, the model was filled by introducing freshwater in the upstream reaches of the rivers and saltwater from the return sump. As the model was filled, a repetitive cosine tide was generated. After a short period of time, tide control was switched to a computer-controlled cosine tide. The tide had a range of 4.25 feet and a mean water

TABLE C-7
POTOMAC ESTUARY TEST
SUMMARY OF INFLOW AND WITHDRAWAL CONDITIONS

Test	Inflow Potomac River (Flow-By) (mgd)	Inflow All Other Tributaries	Estuary Withdrawal Rate (mgd)	Wastewater[2] Treatment Plant Conditions
PHASE 1 - BASE[1]				
1*	0	1960's Drought Flows	0	Present (1980)
2*	100	1960's Drought Flows	0	Present (1980)
3*	500	1960's Drought Flows	0	Present (1980)
4*	900	1960's Drought Flows	0	Present (1980)
PHASE 2 - FUTURE				
5*	0	1960's Drought Flows	0	Projected Future (2020)
6*	100	1960's Drought Flows	0	Projected Future (2020)
7	500	1960's Drought Flows	0	Projected Future (2020)
8*	900	1960's Drought Flows	0	Projected Future (2020)
9*	0	1960's Drought Flows	100	Projected Future (2020)
10	100	1960's Drought Flows	100	Projected Future (2020)
11	500	1960's Drought Flows	100	Projected Future (2020)
12	900	1960's Drought Flows	100	Projected Future (2020)
13	0	1960's Drought Flows	200	Projected Future (2020)
14	100	1960's Drought Flows	200	Projected Future (2020)
15	500	1960's Drought Flows	200	Projected Future (2020)
16	900	1960's Drought Flows	200	Projected Future (2020)

[1] Test to be conducted using a second dye which would be representative of the water quality of the Potomac River over Little Falls.

[2] Present Conditions - 418 mgd; Future Conditions - 705 mgd.

*Test run on hydraulic model

level of +0.18 feet. This tide was representative of the maximum spring tide of the 28-day lunar tide. The tide was repeated until the model reached stability. At a specified time, after both tide and salinity stability had been achieved, the tide was changed to a 28-day lunar tide which was maintained during the hydrograph and steady-state low flow conditions.

Chesapeake and Delaware Canal

The Chesapeake and Delaware (C&D) Canal was not operated during the Potomac Estuary Testing. The associated boundary control conditions of C&D tides, source salinity, and net flows were not applicable.

Freshwater Inflows

The model was stabilized at a discharge of 100,000 cfs using a repeatable cosine tide. After stabilization, the model was stepped through 4-3/4 months of weekly hydrographs simulating the period April - August 1964, to dynamically bring the model to drought conditions. Drought conditions were maintained for a 6-month test period with all inflows, except the Potomac River one, set at the average August - October 1964, steady-state flows. The Potomac River discharge into the upper Potomac Estuary was set at a different rate in each place of the test. This varied from 0 to 900 MGD.

Wastewater Inflows

Wastewater discharge for the Washington area STP's in the upper Potomac Estuary was simulated by constant discharges of a conservative dye (Rhodamine WT). Table C-8 lists the MWA STP's and their respective wastewater flows for the present and future Tests (the future tests represent projected 2020 wastewater discharges).

The wastewater discharges during lead-in steady-state flows were included in the Potomac River inflows. At the start of the hydrograph, the wastewater flow was transferred to the respective outfall locations. Freshwater was used to simulate the wastewater until the dye release started. During a brief period prior to dye releases, the outfalls were disconnected and dye was run through the lines. The wastewater flow rate was measured volumetrically; and at slack after flood at station PO 01-03 (the mouth of the Potomac River), the outfalls were connected and dye was released into the model. Outfalls were set at prototype location and depth. Wastewater specific gravity was set at 1.0.

Ocean Source Salinity

The model ocean source salinity was maintained at 31 ppt for all of the Potomac Estuary tests. Sumps were monitored hourly and salinity adjusted as necessary.

TABLE C-8
POTOMAC ESTUARY TEST
WASTEWATER TREATMENT FACILITIES

Designated Inflow Point (Figure C-16)	Location of Facility	Present[1] (mgd)	Future[2] (mgd)
A	Blue Plains	305	450
B	Piscataway	22	60
C	Arlington	20	30
D	Alexandria	33	40
E	Lower Potomac	38[3]	60
F	Mattawoman	-	65[4]

[1]Based on projected 1980 discharges.

[2]Based on projected capacity requirements for 2020 from current 208 planning documents.

[3]Combined Lower Potomac and Mooney during Base Test.

[4]Combined Mattawoman and Mooney during Futures Test.

Data Collection

Since the major objectives of the study were salinity changes and overall wastewater dispersion characteristics, salinity and dye sampling were emphasized. In order to provide additional data for numerical modeling, tidal heights and velocities were also collected at several stations. A more detailed description of data collection procedures is provided in the following paragraphs.

Salinity Data

Salinity-dye samples were collected at the stations shown in Figure C-16. Samples were taken at slack after flood (SAF) and slack after ebb (SAE). When the water depth exceeded 60 feet, samples were taken at the surface, one-quarter depth, mid-depth, three-quarters depth, and bottom. When depths ranged from 20 to 60 feet, samples were collected at the surface, mid-depth, and bottom. At depths between 10 and 20 feet, samples were collected at surface and bottom. At depths less than 10 feet, samples were collected at mid-depth only.

Sampling commenced at lunar month 1 and tide 42. The upper estuary (PO-06 to PO-16) was sampled at SAF and SAE for the first 15 consecutive tides. The lower estuary (PO-01 to PO-05) was sampled on lunar month 1, tides 42 and 48. Starting with lunar month 2, all stations were sampled on tides 1, 10, 28, and 48 of the 56 cycle - 28-lunar day tide except at the end of the test when tide 42 of lunar month 7 was sampled in lieu of tide 48.

During each test, a synoptic salinity sample was taken of the entire Potomac Estuary on lunar month 3, tide 38, at high water slack at the mouth of the Potomac River. A series of synoptic samples were also taken during Test 9, from the beginning of the dye release until the test start, at 8 tidal cycle increments to establish the initial dye dispersion pattern.

Salinities were monitored at the Chesapeake Bay salinity monitoring stations on the same tides (1, 10, 28, and 48) to establish a representative salinity for all tests. Salinities were continuously monitored and recorded at mid or near bottom depth. Monitoring notes were made approximately every three hours.

Dye Concentrations

Fluorescent dyes were used to trace wastewater effluent and the Potomac River inflow. The wastewater of the Washington area STP's was labeled using a conservative fluorescent dye (Rhodamine WT). The concentration of Rhodamine WT was 1000 parts per billion (ppb) for all tests. The Potomac River freshwater inflow was labeled using a conservative fluorescent dye, Fluorescene, for all base tests and the future tests. The Fluorescene was injected at a concentration of 1000 ppb.

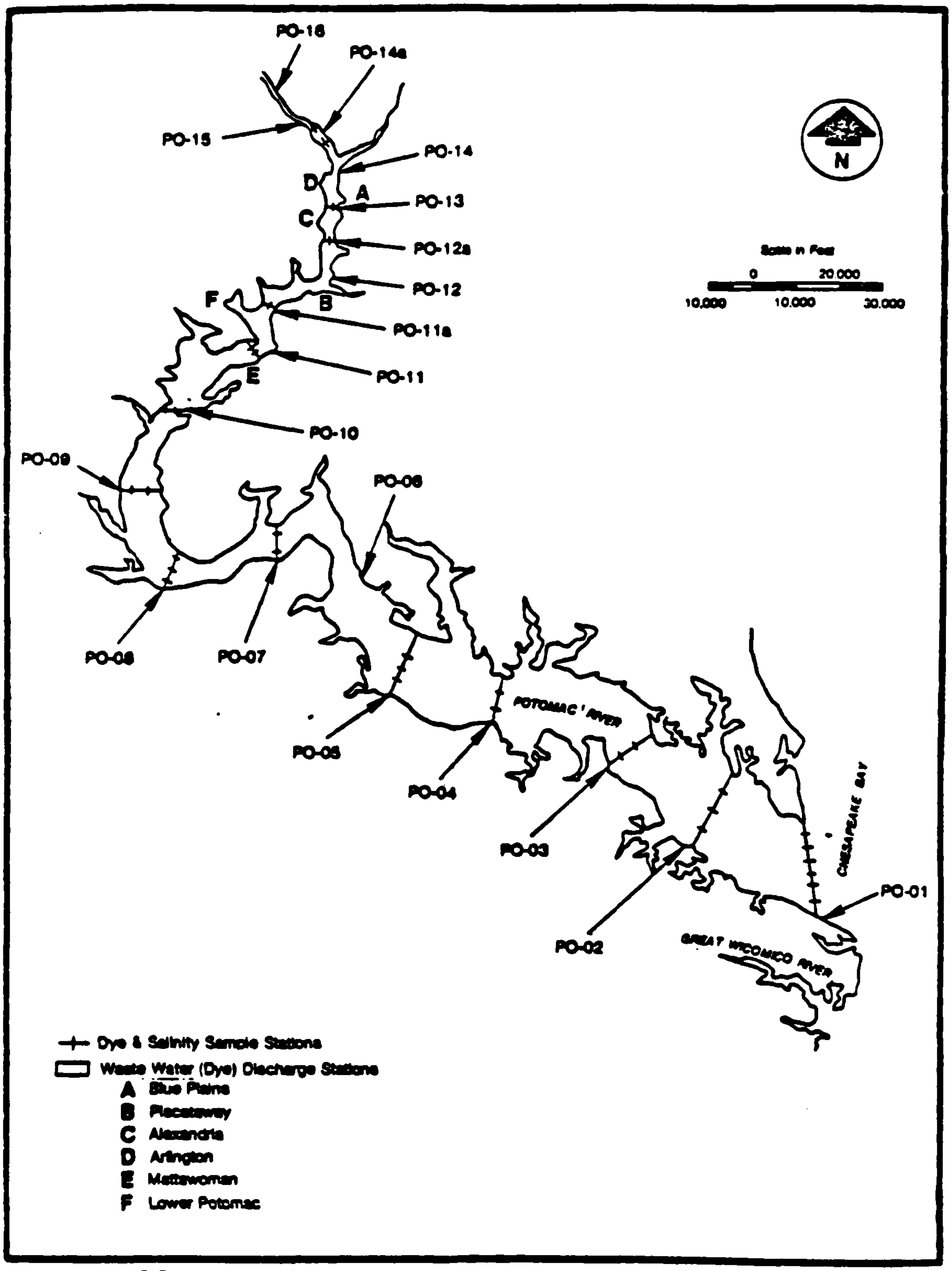


FIGURE C-16 LOCATION OF DATA COLLECTION STATIONS

Dye was released and allowed to achieve a background equilibrium prior to the start of the test. Dye was released at both the Washington area STP's and the Potomac River at a constant flow for the duration of the test. Dye-salinity samples were collected at stations in the upper estuary (PO-9 to PO-16). Dye concentration was also analyzed during the synoptic sampling lunar month 3, tide 38, and during the pre-test for Test 9. Sampling procedures have been described in the preceding discussion of the salinity data.

Tidal Elevations

Tides were monitored throughout the model using nine automatic water level detectors (TDA). Four of the TDAs were positioned in the Potomac Estuary at Cornfield Harbor, Dalgren, Quantico, and Washington D.C. Manual tide measurements were also taken at these locations to give comparative tide values, and to check for TDA error or drift. Manual tide measurements were taken three times per test at the four TDA locations. Tides were measured during lunar months 2, 4, and 6, starting at low water (LW) on tide 53 and continuing on a lunar hour basis to LW of tide 55. Tide 55 was representative of a maximum spring tide.

Current Velocities

Current velocities were collected in two base tests (1 and 4) and two futures tests (5 and 9). Velocities were taken at stations PO-1, PO-6, PO-11, and PO-14 at the same depths as the salinity samples.

Velocities were measured on lunar month 5, between low water of tides 21-22 for the bottom depth, between low water 23-24 for the mid-depth, and between low water 25-26 for the surface. Readings were taken every lunar hour. Tides 22, 24, and 26 were representative of an average tide for the 28-day lunar tide.

Summary of Test Results

As noted in the preceding sections, salinity, dye concentrations, tidal elevation, and current velocity data were collected during the eight tests which were conducted as part of the first phase of testing. Unfortunately, without the data from the eight remaining tests it was not possible to satisfy the objectives of the testing program as originally stated; however, some representative data from the initial tests are presented in the following paragraphs, as well as some generalized statements regarding the significance of these data.

Based on a cursory examination of the salinity data, the test results confirmed expected hydrodynamic conditions in the Potomac Estuary. Salinity declined with the distance from the mouth of the Potomac and varied with the level of Potomac inflows, wastewater discharges, and withdrawal at the Emergency Estuary Water Pumping Station. Further, the longitudinal salinity distribution generally followed observed data with salinity increasing with water depth throughout the Potomac Estuary.

As it related to salinity, the area of greatest interest was the degree of salinity intrusion that occurred under various inflow conditions. Table C-9 provides an overview of the salinity intrusion by showing the estimated time of arrival of various salinities at station PO-16-01 (Emergency Pumping Station Upstream from Chain Bridge). For example, this table indicates that it would take approximately 13 weeks for the salinity to reach 1 ppt

TABLE C-9

POTOMAC ESTUARY TEST
SALINITY TIME OF ARRIVAL AT EMERGENCY PUMPING STATION (PO-16)

Test	Potomac Inflow (Flow-by) MGD	Inflow Other Tributaries	Wastewater Treatment Plant Conditions	Estuary Withdrawal (MGD)	Salinity Time of Arrival (in Weeks) at Emergency Pumping Station[1] Salinity Level in ppt[2]			
					1.0	2.0	3.0	4.0
Phase 1 - Base								
1	0	1960's Drought Flows	Present (1980-418 mgd)	0	9	13	18	22
2	100	1960's Drought Flows	Present (1980-418 mgd)	0	13	20	22	24
3	500	1960's Drought Flows	Present (1980-418 mgd)	0	-	-	-	-
4	900	1960's Drought Flows	Present (1980-418 mgd)	0	-	-	-	-
Phase 2 - Future								
5	0	1960's Drought Flows	Future (2020-705 mgd)	0	10	20	22	-
6	100	1960's Drought Flows	Future (2020-705 mgd)	0	14	17	21	-
8	900	1960's Drought Flows	Future (2020-705 mgd)	0	-	-	-	-
9	0	1960's Drought Flows	Future (2020-705 mgd)	100	9	13	20	25

1. Given that the model was brought to drought conditions by simulating the period April-August 1964, this represents the number of weeks it would take the salinity to reach the designated value with a steady-state Potomac inflow as noted.

2. Salinity samples taken at the bottom of the section.

at PO-16 assuming a Potomac inflow of 100 mgd. Given the nature and duration of both the 1960's and 1930's droughts, it is not unreasonable to assume that salinity intrusion could occur and may present a potential treatment problem for an estuary treatment facility. It should be recognized, however, that the severe salinity intrusion occurred at only the lowest flowby values and during the latter part of the drought period.

As a further example of some of the salinity results, included as Figures C-17 and C-18 are a longitudinal salinity distribution profile for the entire Potomac River Estuary and a salinity time history for several stations. Both of these figures are based on salinity data from Test 2 of the Phase I testing which reflects the base conditions and a Potomac inflow of 100 mgd. These two figures also supported the conclusion that during a severe, prolonged drought, nearly the entire Potomac Estuary to Little Falls is subject to saline water intrusion for Potomac flowbys of 100 mgd or less. This conclusion was further supported by the results of the Low Freshwater Inflow Study model testing which also demonstrated rather extensive salinity intrusion under prolonged drought conditions.

It should be noted that a more refined estimate of the extent and duration of the salinity intrusion plus the impacts of varying levels of estuary pumping could not be developed without the remainder of the hydraulic model testing.

It was also difficult to draw any conclusions relative to wastewater dispersion patterns using the results of only the initial dye dispersion testing. As noted in Figure C-19, concentrations of dye on the order of 200 ppb do reach a point midway between station PO-15A (Georgetown Reservoir) and Station PO-16 (Chain Bridge) under base conditions (Test 2) and a 100 mgd Potomac River inflow. The source dye for this test was Rhodamine WT which was released at the Washington area sewage treatment plants noted on Figure C-16. It should be noted that the hydraulic model testing provided only the dispersion characteristics of a conservative dye and not the level of pollutants that could be expected at any given point in the model. It was originally intended that following completion of the second phase of the physical model testing, the physical model data would be used as input to the Environmental Protection Agency's Dynamic Estuary Model (numerical) which would then be run to provide estimates of the levels of pollutants under the various conditions tested. Unfortunately, the second phase of the hydraulic model testing was not conducted and there are insufficient data to conduct the numerical modeling. No conclusions relative to the level of pollutants at any proposed estuary water treatment plant location can be provided at this time.

Generally, it would appear that the suitability and treatability of the estuary water would be more of a function of the levels of salinity that could occur under drought conditions rather than degraded water quality from the sewage treatment plants in the Metropolitan Washington Area. Further hydraulic and numerical modeling should be conducted prior to any recommendation for use of the estuary as a future source of supply.

NORFOLK HARBOR AND CHANNELS DEEPENING TEST

Description and Objective of Testing

Norfolk, Virginia, located near the mouth of Chesapeake Bay has played a major role in waterborne commerce along the east coast of the United States. In 1980 the Norfolk District, Corps of Engineers, completed a study of the feasibility of deepening the harbor and approach channels from 45 to 55 feet.

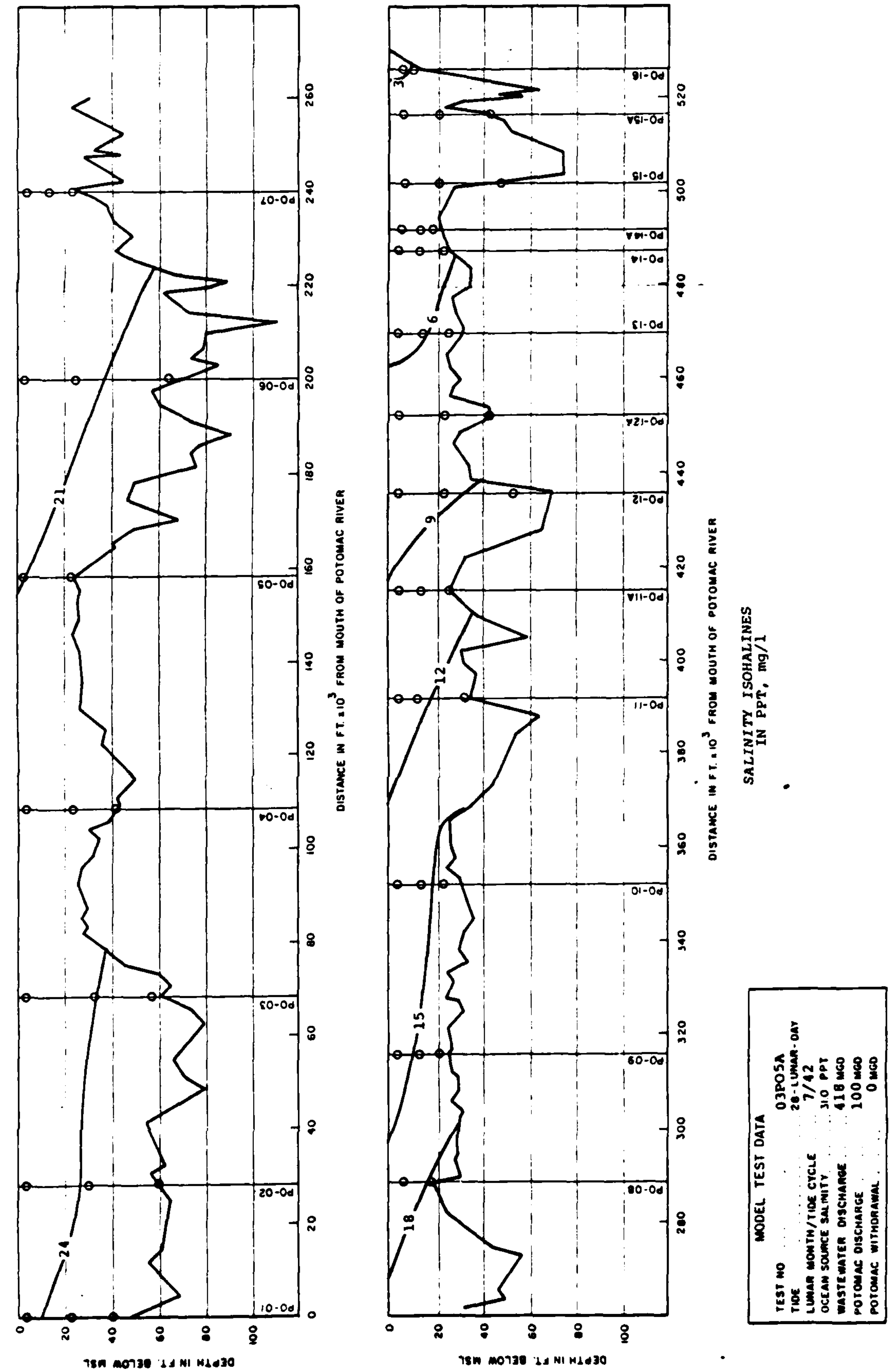


FIGURE C-17 POTOMAC ESTUARY MODEL STUDY - SALINITY PROFILES

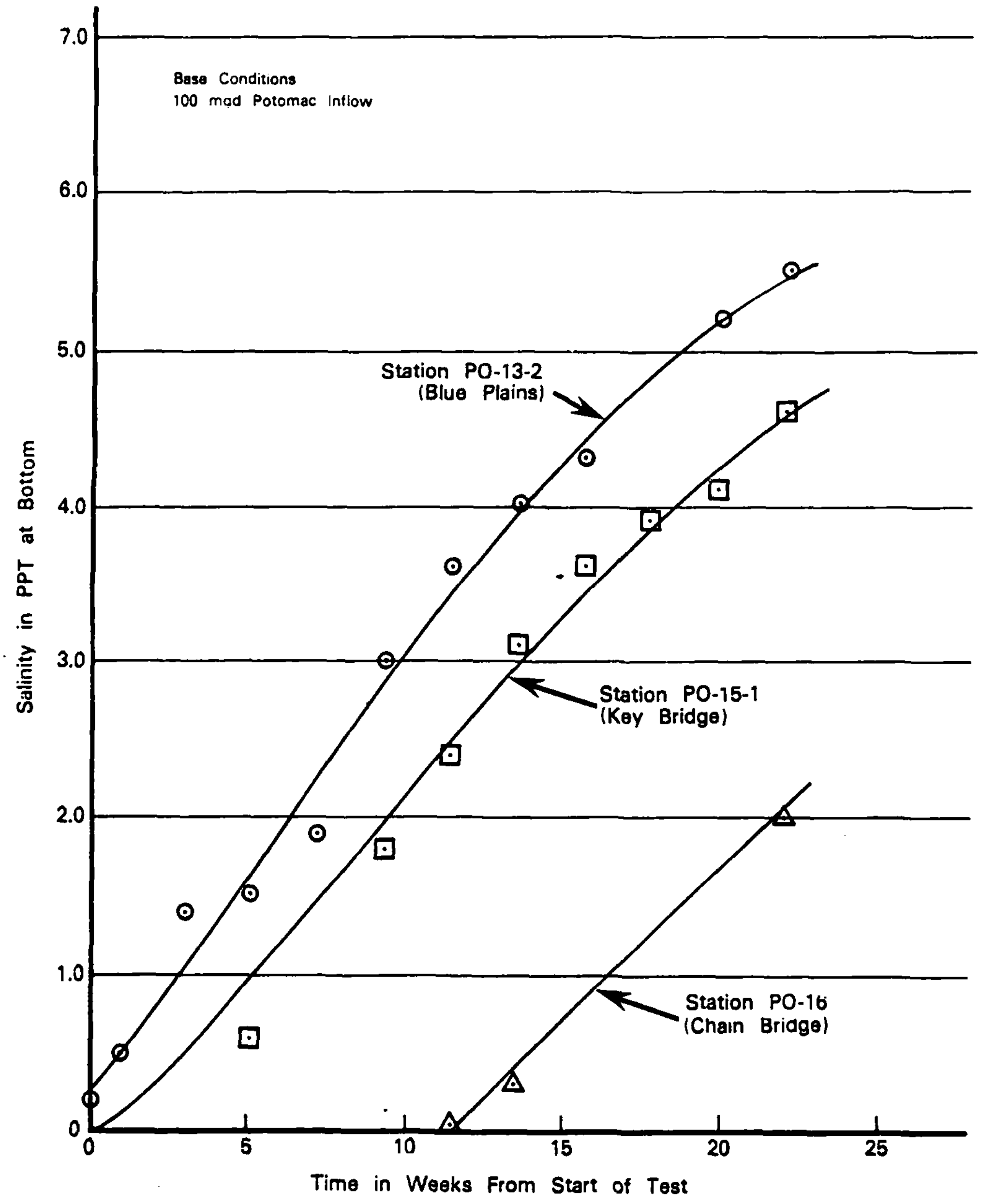


FIGURE C-18 POTOMAC ESTUARY TEST SALINITY TIME HISTORY

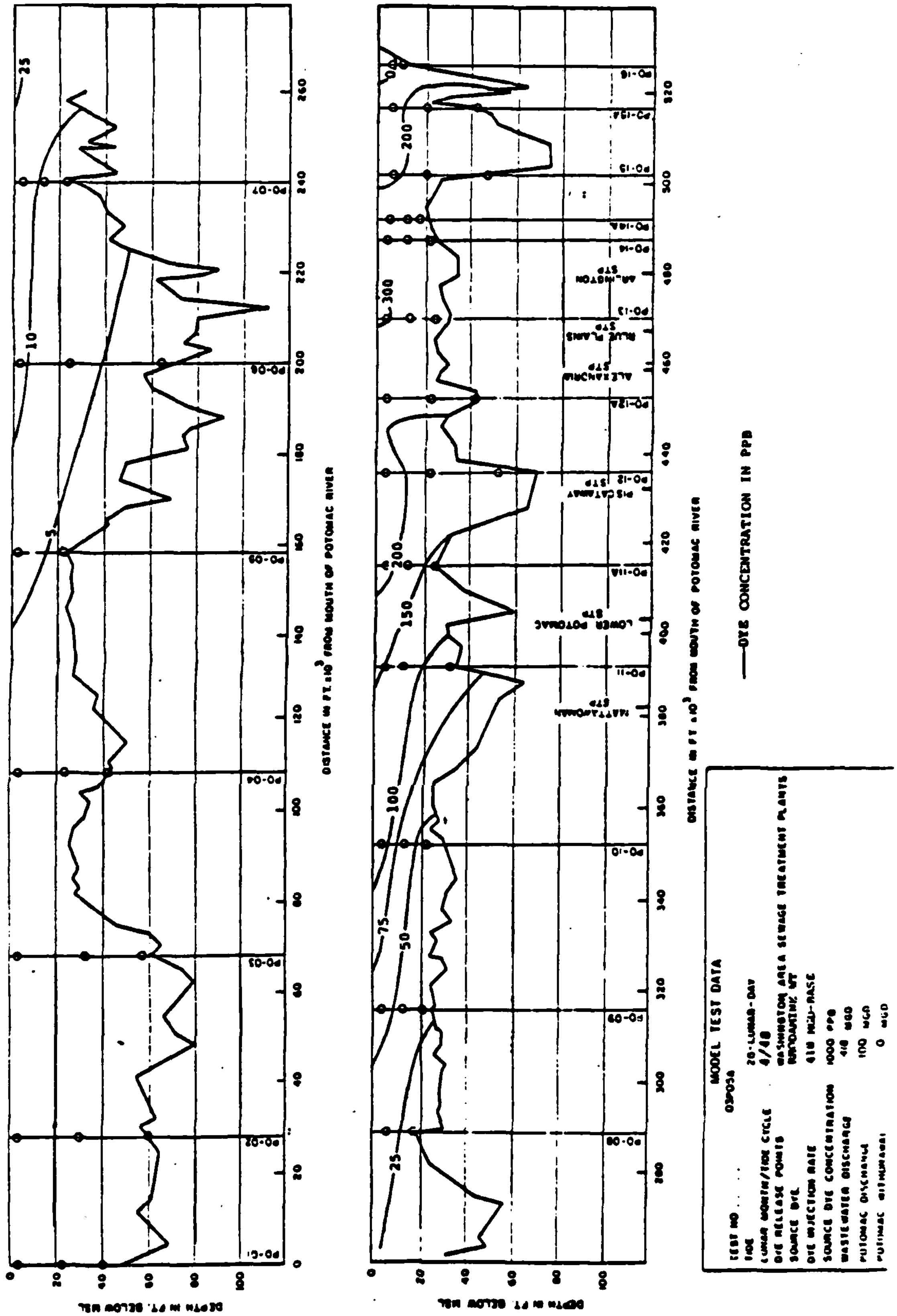


FIGURE C-19 POTOMAC ESTUARY MODEL STUDY - LONGITUDINAL DYE CONCENTRATIONS

The objective of the model testing was to investigate the impact of the proposed channel deepening on the hydrodynamic characteristics of Chesapeake Bay. The study was designed specifically to determine what changes in tidal elevations, current velocities and salinities could be attributed to the proposed channel deepening.

The hydraulic model testing consisted of two parts. The first was a series of four steady-state tests (constant discharge and cosine tides) designed to study base versus plan differences in tides and current velocities. Both base and plan geometries were tested under medium and high tide ranges and freshwater discharge conditions. The boundary conditions and sampling procedures for the steady-state tests were dictated by the needs of numerical models for subsequent studies of sediment transport and shoaling in the dredged channels and neighboring bottom areas.

The second part of the study was a dynamic test (variable discharge and variable tides) designed to predict base versus plan differences in salinity response. A 2-1/2 year variable hydrograph was used with a repetitive 28-lunar-day variable tide for both base and plan tests. The ocean source salinity was the same for both steady-state and dynamic tests.

Model Test Conditions

Model Geometry

For base condition testing, the model geometry was as constructed and verified with the addition of the proposed 50-foot Baltimore Harbor and channels. For the plan testing, the proposed Norfolk Harbor and Channels to include three feet of overdepth dredging were added to the model.

Tidal Conditions

For the steady state testing, the ocean boundary was operated under a repetitive cosine tide having ranges of either ± 1.50 or ± 2.40 feet. For the dynamic testing, a repetitive, 28-lunar-day 56-cycle tide sequence was used. During both the steady state and dynamic testing, tides were generated at only the Atlantic Ocean Boundary. The Chesapeake and Delaware Canal source tide was not operated.

Freshwater Inflows

During the steady state testing, total Bay inflow was held constant at either 70,000 or 200,000 cfs. For the dynamic testing, a 15-week lead-in steady state inflow of 70,000 cfs followed by the natural hydrograph for the period May 1963 to August 1965 was used.

Sewage Treatment Plant and Other Inflows

In addition to the river inflows, five sewage treatment plants on the James River and the Surry Nuclear Power Plant cooling water diversion were operated throughout the testing.

Ocean Source Salinity

The source salinity for the entire model study was 32.5 ppt. Control of the source salinity during the steady-state tests was considered good with any minor variations being incapable of causing any observable base versus plan differences in tides or velocities.

Data Collection

Tidal Elevations

During the steady-state testing, model tide observations were made at the 17 stations shown in Figure C-20. Tide elevations were recorded hourly (prototype) over two tide cycles. These tide measurements were made both manually using point gages and automatically using the electronic water level detectors. In a similiar fasnion, tidal elevations were also recorded during the dynamic testing.

Current Velocities

Model velocities were measured during the steady state tests at the 32 stations shown on Figure C-21. The velocity measurements were made concurrent with the tidal elevations discussed in the preceeding paragraph. In addition, current direction data were collected at 26 of the velocity stations.

Salinities

Salinity sampling stations were located at 193 points throughout the Bay so that effects on the entire system could be determined. The majority of the stations were located near the area of the proposed deepening with care taken to select biologically sensitive areas. Samples were taken at from one to five depths per station. The samples were collected at slack after flood at tide 1, 10, 28, and 48 of the 28-day tidal cycle. These corresponded to the neap and spring tide occurrences.

Summary of Test Results

Changes in tidal elevations, amplitudes and phasing which may be due to the effects of channel deepening were sufficiently small that they were undetectable with the measurement techniques used at the hydraulic model. Model measurement techniques are of sufficient accuracy that significant changes would have been noted, therefore, none are expected.

Several subtle velocity variations in the model tests were apparently due to channel deepening. An overall decrease in velocity amplitude of about 0.13 fps was noticed during the plan test. This is consistent with the principles of continuity, but the magnitude of change is close to the accuracy limitations of model instrumentation. Slight increases in flood dominance were noticed under average inflow conditions indicating perhaps that salinity intrusion may move upstream in the study area. This observation is consistent with the observed increased salinities. Overall changes in model velocities could be attributed to the effects of channel deepening, but the magnitude of the changes is barely detectable.

Variations in the model salinity distribution were noticed which could be attributed to channel deepening. The greatest differences were noticed in the deepened channel areas where increases in the bottom salinities varied between 0.0 and 4.0 ppt. Average increases in the channels varied between 0 and 2 ppt. Overbank areas in the project areas experienced a lesser salinity increase. At times there was actually a slight freshening of the overbanks. Stations elsewhere in the model showed modest increases in salinity, but were normally less than 2 ppt most of the time.

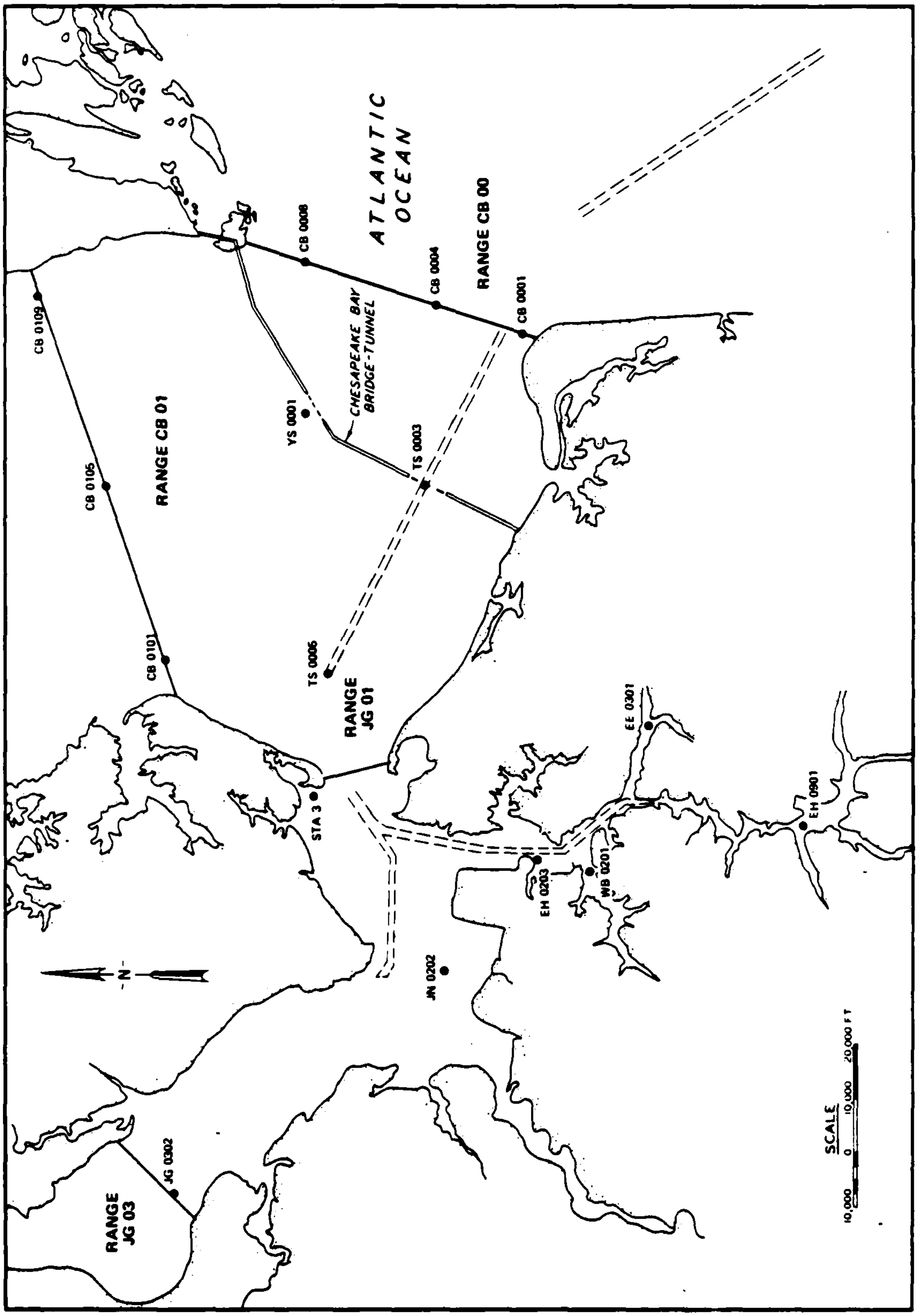


FIGURE C-20 NORFOLK HARBOR TEST TIDAL ELEVATION STATIONS

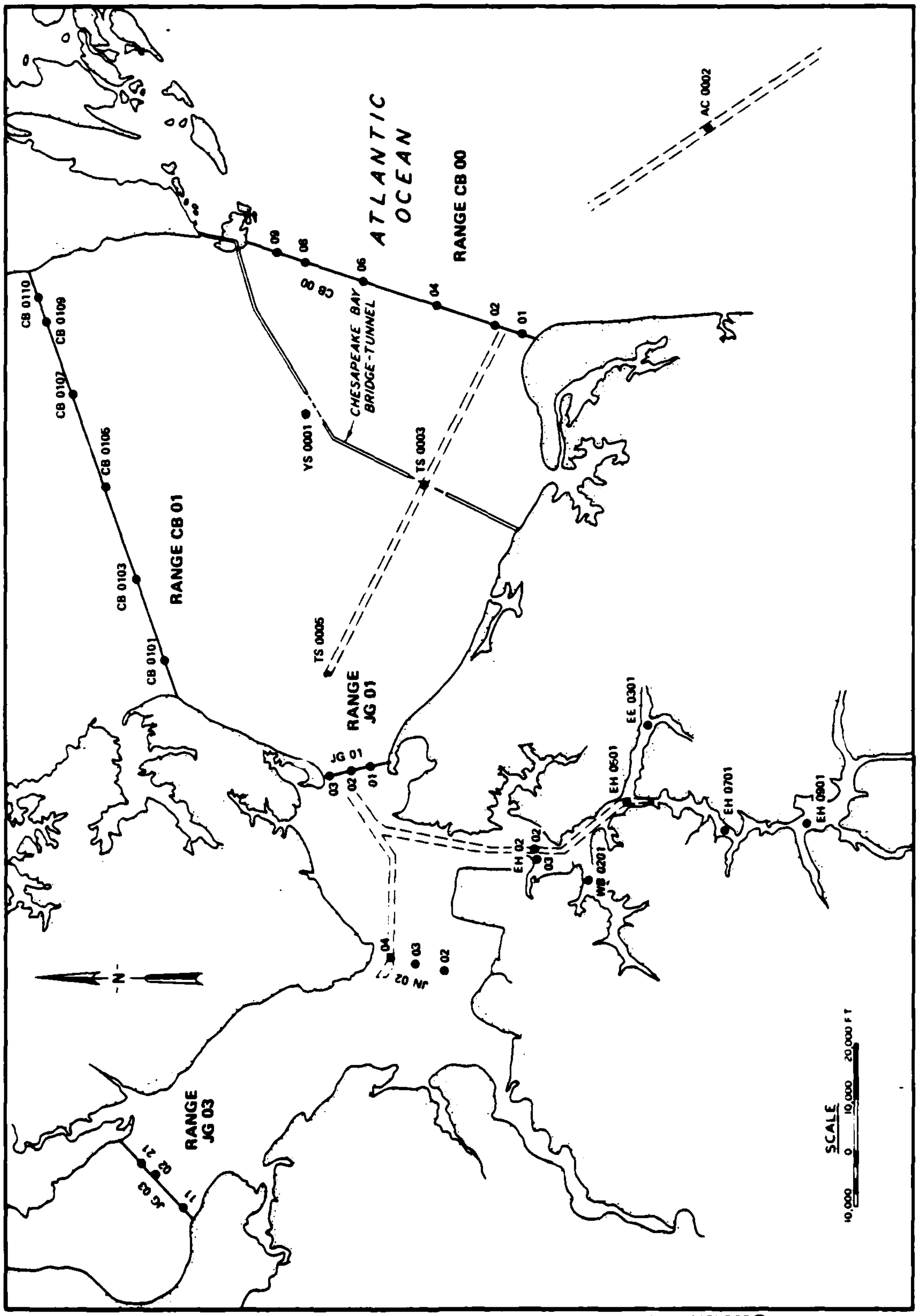


FIGURE C-21 NORFOLK HARBOR TEST VELOCITY STATIONS

The salinity tests documented the locations of stations in the study area which exhibit large (commonly as great as 5 to 8 ppt) salinity changes during the neap-spring tide cycle. The entire study area experienced these variations which are naturally occurring and not caused by channel deepening. Salinity changes caused by channel deepening are much smaller than those naturally occurring changes. Furthermore, the small changes due to channel deepening are concentrated in deep channel areas and not in the overbank areas where sensitive biological communities exist.

More detailed information on the model test results is in Technical Report HL-83-13, Norfolk Harbor and Channels Deepening Study, June 1983, prepared by the Hydraulic Laboratory of the U.S. Army Engineer Waterways Experiment Station.

JAMES RIVER OIL DISPERSION TEST

In February 1979, a series of oil spill experiments were conducted on the model to simulate the effects of tidal currents on the dispersion of an oil spill near the mouth of Chesapeake Bay. The testing was conducted for the Office, Chief of Engineers as part of a technical and environmental evaluation of a proposed permit for the construction of an oil refinery in the Hampton Roads area.

Five oil spills were simulated during the testing. The volume of the spills ranged from 500,000 to 7,000,000 barrels with the period of the release varying between 1 hour for the smaller spills and 96 hours for the larger spills. Ten Hasselbad 70 mm cameras were used to document the oil spill trajectories. Photos were taken hourly (prototype) during the early parts of each spill and only at slack water during the later stages of the tests. One 16 mm time lapse camera was used in the region of the oil spill to provide more continuity. The sense of motion provided by the time lapse camera and the continuity in space provided by the mosaics of the Hasselbad photos provided a reasonably accurate reconstruction of the oil motion. Technicans were also used to make visual observations of the oil motion during the simulations. Given the aforementioned photo mosiacs judgements were made as to the extent of the spread of the spills and the potential of the spills to penetrate the James River and reach its extensive oyster seed beds.

TESTING FOR OTHERS

NANTICOKE RIVER, MARYLAND, DYE DISPERSION TEST

Description and Objective of Testing

Sharptown, Maryland, is located on the Nanticoke River about 31 miles upstream from its mouth. The Nanticoke River drains a 700 square mile watershed and has an annual average discharge of approximately 840 cfs. About 40 miles of it is effected by the tide. On the west bank of the river at Sharptown, there were approximately 30 chemical storage tanks containing approximately 170,000 gallons of various toxic chemicals and industrial solvents. The objective of the test, which was done at the request of the State of Maryland, was to define the geographical extent of the "worst case" effects from a hypothetical release of a toxic substance at Sharptown. This was accomplished by defining the temporal and spatial distribution of a neutrally buoyant conservative contaminant in the Nanticoke River representative of an accidential chemical release at Sharptown. A fluorescent dye was used as the tracer material.

Model Condition

The condition of the Chesapeake Bay and the Nanticoke River at the time of the chemical spill determines, to a large extent, the dispersion of contaminants in the system. Since this condition can vary considerably and is unpredictable, a moderate approach to prototype simulation was taken. To achieve this result, annual average freshwater inflows and a slightly less than mean-ranged repeatable ocean cosine tide were used. Boundary conditions for the test are shown in Table C-10.

The ocean boundary was cam operated under a repetitive cosine tide with a high water of 1.3 ft and a low water of -1.3 ft. This resulted in a 1.9-ft tidal range at Vienna which is slightly less than the average range of 2.3 ft reported in the tide tables.

Freshwater inflows into the Nanticoke were confined to the upstream limits of the model at three locations, i.e. Seaford, Delaware, Federalsburg, Maryland, and Quantico Creek. The designed flows were 391, 253, and 197 cfs, respectively. The source salinity was maintained at 32.5 ppt total salt throughout the test, and the model was operated until salinity stability had been achieved prior to initiating the dye release. The dye release point was at sta N-4 (Sharptown, Figure C-22), and 5.9 ml of Rhodamine WT dye solution (approximately 2 ppt) was injected at the time of slack before flood of the first tidal cycle of the dye test. The dye was injected at middepth over a 3 second period.

Data Collection

Sampling stations were located throughout the Nanticoke River area (see Figure C-22). Real time analyses were performed on several stations to determine the movement of the dye. In this way, additional mobile sampling stations could be added if they were needed. For stations where the prototype depth was between 20 and 60 ft, three samples were taken in the vertical (surface, middepth, and bottom). Where the depth was between 10 and 20 ft, surface and bottom samples were taken; and for depths less than 10 ft, a single middepth sample was taken. Sampling started at the second slack before ebb after the dye injection and was continued at prescribed slacks for 58 tidal cycles. Slack water was considered synoptic about sta N-3A (Vienna). Hourly samples were taken at sta N-3A and N-3B during tide 13 so that the concentration distribution through one tidal cycle could be determined. Approximately 700 samples were taken during the test. The samples were collected by vacuum aspiration and taken to a temperature-controlled room where fluorometer readings were taken for each. Tidal elevations and tidal current measurements were made at sta N-3A and N-3, respectively, before and after the test.

Summary of Test Results

Based on an analysis of the test results, it was noted that peak concentrations of contaminents in the river tend to decrease with successive tidal cycles with a net transport of dye mass proceeding slowly downstream. The farthest upstream intrusion occurred at Seaford (station N-6) after 43 tidal cycles. The arrival of the dye at the most downstream sampling location (station N-1, near the mouth of the river) occurred between slack before flood of cycle 40 and slack before ebb of cycle 43.

TABLE C-10

NANTICOKE RIVER TEST
BOUNDARY CONDITIONS

Tides	Ocean	C&D Canal
Range, ft	2.6	Not operating
Amplitude, ft	1.3	Not operating
Plane, ft	0.0	Not operating
Source salinity, ppt	32.5	Not operating

Freshwater inflow:

Inflow No.	Tributary	Discharge, cfs
1	Nansemond R.	676
2	Chickahominy R.	289
3	Appomattox R.	967
4	James R.	7,249
5	York R.	2,659
6	Rappahannock R.	2,842
7	Wicomico R.	412
8	Occoquan Cr.	2,370
9	Anacostia R.	582
10	Potomac R.	7,699
11	Patuxent R.	881
12	Severn R.	231
13	Patapsco R.	613
14	Gunpowder R.	802
15	Susquehanna R.	37,217
16	Bohemia R.	386
17	Chester R.	402
18	Wye R.	190
19	Choptank R.	1,216
20	Nanticoke R.	403
20M	Marshyhope Cr.	249
20Q	Quantico Cr. (sums adjacent basins)	196
21	Pocomoke R.	1,369

Total discharge in Bay-70,000 cfs

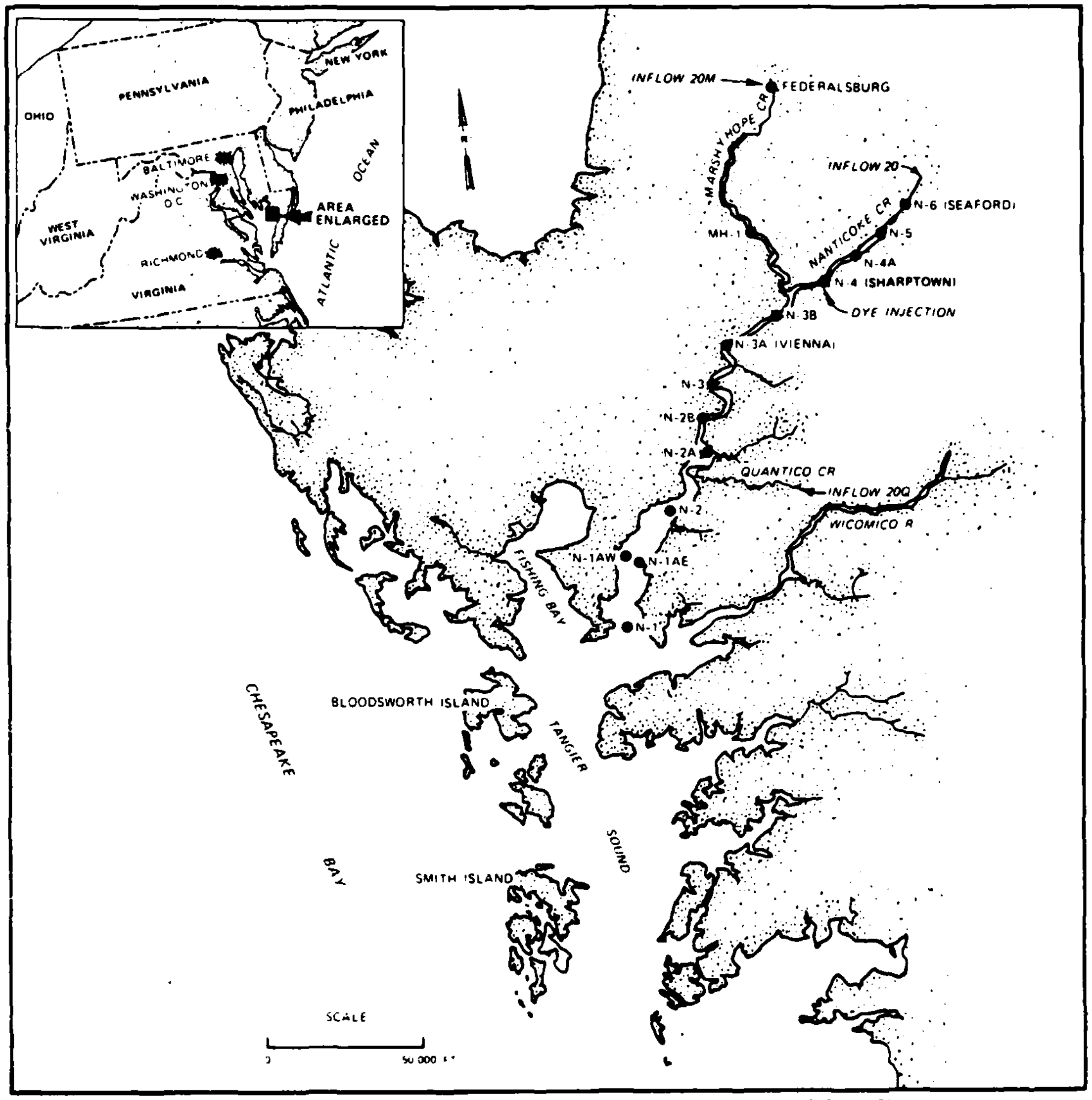


FIGURE C-22 SAMPLING STATIONS ON NANTICOKE RIVER

The boundary conditions in the Nanticoke River and Chesapeake Bay can have an effect on the dispersion of dye. Should a higher freshwater discharge occur on the Nanticoke River and/or Marshyhope Creek, one could expect faster flushing toward the Bay with smaller concentrations observed upstream as compared with the results for the conditions tested. Conversely, if lower freshwater discharges occur, one could expect a slower flushing rate with higher concentrations upstream.

The tidal condition at the time of injection can affect the dispersion of dye. Spring tides would tend to increase dispersion in upstream and downstream directions; neap tides would decrease this amount of dispersion. The time of injection within a single tidal cycle can also affect the dispersion. If injection occurs on a slack before flood, the concentrations upstream will be larger than if injection occurred on a slack before ebb.

The density and solubilty of a particular contaminant can have an effect on its dispersion in the system. A contaminant that settles on the bottom will disperse at a rate different than the one that floats on the surface or one that mixes in the water column. The physical properties of the particular contaminant should be considered prior to applying these results to any given chemical spill.

For a more detailed discussion of the testing and the results, the reader is referred to *miscellaneous paper HL-81-2, titled* Nanticoke River, Maryland, Dye Dispersion Study prepared by the Hydraulic Laboratory, Waterways Experiment Station, Corps of Engineers.

DISASTER RECOVERY TESTING

Over the years the model was in operation, there were several occasions when it was used to aid disaster recovery operations. The most notable of these tests were conducted in October 1978 following the sinking of the Coast Guard Cutter Cuyahoga and in January 1982 after the crash of an Air-Florida jetliner in the Potomac River at Washington, D.C. In both cases, the model was run for a short period of time under "average" conditions to determine the most likely location of the victims of these tragedies. It should be noted that in both cases the model served as a reasonably accurate guide for the body recovery operations.

PATUXENT AND CHESTER RIVER PROTOTYPE SURVEY DESIGN TEST

Concurrent with an on-going Corps of Engineers test, confetti was distributed on the Patuxent and Chester River segments of the model to determine surface current patterns over several tidal cycles. This brief, undocumented test was done for the University of Maryland Center for Estuarine and Environmental Studies to assist in the design of a sampling network for studies of the Patuxent and Chester River subestuaries.

LAFAYETTE RIVER WASTEWATER DISPERSION TEST

As part of the Sea Grant Program, Old Dominion University conducted a study of the pollutant fields caused by discharges from pleasure boats. The area of focus of the study was a group of marinas on the Lafayette River which is a tributary of the Elizabeth River in Norfolk, Virginia. The hydraulic model was used for a set of continuous and distributed Rhodamine dye releases at a location on the Lafayette River near the marinas. The model dispersion data were then compared with similar prototype dye releases to determine the applicability of physical modeling as a water quality management tool. More detailed information on the study and the testing may be obtained from the Department of Mathematical and Computing Sciences and Institute of Oceanography of Old Dominion University.

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